COLONIC IRRIGATION

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INTRODUCTION

THERE have always been fashions in medicine, and the history of the clyster illustrates this ebb and flow of popularity in a striking degree. The clyster became supreme in the medical practice of the seventeenth and eighteenth centuries, when it shared with emetics and venesection the medical honours of the day. It was thought that these three methods furnished the most satisfactory means of gaining access to the diseased tissues and fluids of the body and dispersing the peccant humors. Though there are certain differences between clysters and irrigations, it is not possible to draw a definite dividing line between them, as the one merges insensibly into the other.

It is strange how valuable methods of treatment are often allowed to fall into disuse. Perhaps the most striking example of this is furnished by sun-bathing, which is only now being revived after nearly two thousand years of oblivion and neglect.

Colonic therapy is another ancient method which, it is known, was used fifteen hundred years before the birth of Christ. Why did the popularity of the clyster in the seventeenth and eighteenth centuries disappear at the commencement of the nineteenth? The reason is probably furnished by the amazing variety of purgative pills which the enterprising manufacturer has showered so lavishly on the world at large. Little thought has been paid to the fact that most of these purgatives act by irritating the sensitive mucous membrane of the bowel, and that once the bad habit of self-medication is established, progressively larger doses of the drug must be taken. Symptoms may be temporarily relieved in this way, but the condition can

never be cured. Evans sounded a serious warning when he said: "There can be little doubt that almost as much disease and distress of a low-grade and chronic type is caused by the habitual use of laxatives as results from the abuse of alcohol and other stimulants." Unfortunately, the only thought of the purgative devotee has been whether the drug has acted or not, and no consideration has been given to the harm that was likely to follow its habitual use. The continued use of purgatives for the treatment of chronic constipation can therefore no longer be considered reasonable or justifiable. It is surprising how many persons, who would never think of prescribing treatment for themselves for any other condition, will, nevertheless, have no hesitation in regularly taking various purgative drugs of which they have the scantiest knowledge. The expenditure on patent medicines in this and other civilised countries is enormous, and the majority of these medicines contain drugs of a purgative nature.

This curious and unsatisfactory state of affairs probably arises in part from the fact that many people shrink from consulting their doctor about what they consider to be such a trivial, and at the same time delicate, matter. They, however, seem to have no hesitation in accepting the advice of an acquaintance. Most lay persons would be greatly surprised if they realised how difficult it frequently is to determine the exact cause of constipation. Every competent medical practitioner would demand to be allowed to test the patient's urine before being willing to offer an opinion as to the state of his kidneys, and yet how many practitioners diagnose the condition of the bowels without ever examining the fæces? The patient, if he should happen to go to his practitioner, generally informs the doctor of the diagnosis. There is no doubt at all that constipation is a most potent cause of a great deal of human suffering; it probably is indirectly responsible for more misery than many of the so-called

killing diseases. We are rather apt to forget the intimate interdependence which exists between the different parts of the body. There is rather a tendency to think of the body as consisting of a number of isolated organs. It is, however, obvious that chronic stagnation of the bowels must lead to a chronic poisoning of the whole system. Chronic constipation lessens the resistance of the body to infecting organisms; it may also cause auto-intoxication and accentuate any existing disorder. The penalties of neglecting the human drainage system are indeed immeasurable.

One of the first inquiries a medical practitioner makes when visiting a patient is to ascertain how the bowels are functioning, remedial measures being invariably prescribed if there is any disturbance in this respect. It is clearly of supreme importance that the chief eliminative organ of the body should be in satisfactory working order, otherwise a perfect state of health is, obviously, not possible.

How, then, should chronic constipation be treated if not by purgatives? Colonic irrigation furnishes the answer. Here is a method which has been successfully used in its cruder forms for thousands of years. As Alvarez has said: "Why upset twenty-four feet of intestine with a purgative when the material to be removed is in the rectum or sigmoid, within easy reach of a little water."

The fact that certain individuals may exploit colonic irrigation or use it indiscriminately does not constitute a sound reason for condemning it. There are physicians, too, who make a practice of prescribing colonic irrigation, and yet who, unfortunately, allow a nurse, of whose qualifications they are probably quite ignorant, to carry out the whole procedure. They, themselves, are never present during the administration of treatment, and they never examine the effluent matter, but allow the whole course of treatment to be based on the nurse's report. The author has had personal experience at Plombières

of the disadvantages associated with that method of administering colonic lavage. The latest methods of continuous irrigation, however, are such an immense improvement on the older systems, that it is of the greatest importance that the widest possible attention should be paid to them. Too frequently one hears the remark made that the speaker has no use for these complicated new-fangled methods of colonic lavage, but prefers the simple system. This statement displays a complete ignorance of the efficiency and simplicity of the new methods of continuous colonic irrigation and their immeasurable advantages over the Plombières and other old processes. One earnestly hopes that the medical profession will not allow these excellent methods to be used solely by the untrained layman, or else progress will inevitably be slowed.

These new systems enable the physician actually to cure constipation by means of colon gymnastics which stimulate the bowel to perform its function, this being the only rational method. Colonic irrigation carried out in this way has a wide range of usefulness, not limited by any means to the treatment of such conditions as constipation or diarrhœa, but includes the cure or alleviation of such diverse disorders as ureteric calculi, urticaria, enteroptosis, etc.

Colonic irrigation is a branch of that rapidly widening subject—Physical Medicine. Recently, when writing about ultra-violet radiation, the author expressed the opinion that it is advisable for us to follow the example of several of our Continental neighbours and institute compulsory lectures, practical work, and examinations in physical medicine for all students taking their qualifying degree. Great progress would then take place, and the administration of these important methods of treatment would—to the great benefit of mankind—no longer be relegated to the charlatan and quack as, unhappily, is too frequently the case at the present time.

COLONIC IRRIGATION

CHAPTER I

THE HISTORY OF CLYSTERS AND COLONIC LAVAGE

In the "New London Dispensatory" (1678) the following definition of a clyster appears: "A Clyster is a Liquor or decoction of Medicinal things conveyed into the Guts by a Pipe: the liquor is made of Various things according to the intention as of Plants, Seeds, Grain, Flesh boyled in Water, Ale, Beer, Wine, Milk, Whey, Urine, Oyl."

Murray's "Oxford Dictionary" defines a clyster or enema as a liquid or gaseous substance (either medicinal or alimentary) introduced mechanically into the rectum.

Prescriptions for enemas have frequently been found on Babylonian and Assyrian tablets.

In the famous Ebers papyrus, which is an ancient Egyptian document dealing with the practice of medicine, and which was written about 1500 B.C., although most of its contents were copied from a series of books many centuries older, there are a great number of prescriptions for the purgative remedies, or, as it states, remedies "to drive out the excrement in the body of a person." Although a number of the remedies were to be taken by the mouth, others were to be made into enemas and injected into the rectum. Ox bile was one of the substances recommended for this purpose. Rectal administration of medicaments is, undoubtedly, a very ancient procedure. Herodotus of Halicarnassus, in his

account of Egypt and the Egyptians, said: "Their manner of life is this: they purge themselves every month, three days successively, seeking to preserve health by emetics and clysters, for they suppose that all diseases to which men are subject proceed from the food they use." Hippocrates taught that enemata were generally preferable to purgatives. Pliny tells how the Egyptians credited the ibis with the discovery of the enema. De Graaf, in his treatise on clysters, makes an amusing reference to this legend. "It is said that a certain bird, similar to the stork, called the ibis, and peculiar to Egypt, showed man the secret of lavages, because when it wants to evacuate, it syringes the anus with its beak filled with water from the sea." De Graaf prefers the simple saline injection to the more diverting concoctions advocated by others, for he writes: "For myself, guided by reason and the ibis, I am persuaded that a clyster of sea-water or of pure water in which is dissolved a small quantity of salt or human urine is sufficient." Paré refers to the same legend, and says: "Galen hath attributed to Storkes the invention of Glysters, which with their Bils, having drunke Sea Water, which from saltnesse hath a purging quality, wash themselves by that part, whereby they use to bring away the excrements of their meates, and of the body."

One curious method of treatment which was in vogue in the eighteenth century consisted of the injection of tobacco smoke into the rectum. The procedure was employed for the resuscitation of the apparently drowned, or for the revival of new-born infants. Later, it was even used for the treatment of colic, constipation, and strangulated hernia. A special apparatus, known as the fumigator, was utilised for the administration of the treatment. It consists of a metal box in which burning tobacco was placed, and a pair of bellows for the purpose of blowing the smoke into the bowel through a clyster tube of De Graaf's design.

Celsus, in Book II., chapter xii., says: "In most cases the bowel must be emptied by enemas. . . . Enemas are particularly called for if the excreta accumulate near the exit, or if a patient suffering from constipation has a breath smelling of excrement, or when his excreta are putrid, or when fever cannot be rapidly improved with fasting . . . or when there is a sudden and unrealled for constipation."

In the "New London Dispensatory" there is a prescription for a Specifick Clyster which, it says, "is a Specifick in the cure of Melancholy, Sadness, Sorrow, Loss of Sense, Quartans, Scabs, Ring-worms, Morphew, Cancers, Elephantiasis, Schirrus of the Spleen, and against all Diseases proceeding from Melancholy."

Even though a metal syringe was found in the excavations at Herculaneum, it is doubtful whether it had ever been used for medical purposes. The earliest recorded method of administering an enema was with an appliance consisting of a tube or cannula made of reed, bone, or metal, to one end of which a bladder or sleeve—generally made of an ox's bladder, a cat's skin, or silk cloth—was attached. It was often known as the "clyster purse." The bag was emptied by squeezing it between the two hands. In Spain, the method was called "playing the bagpipes." The clyster purse was followed by the clyster syringe, although at what date is rather doubtful, probably at different times in different countries. The enema syringe was described as far back as the tenth century by Avicenna, the greatest of Arabian philosophers and physicians, in his "Canon of Medicine."

There are a great number of references in old medical books to the use of clysters. John Arderne (1306-90 ?), the first recorded English surgeon, who first practised in Newark and later in London, wrote an essay on the value of clysters, advocating the use of an instrument he had designed. Trevisa, in his translation (1398) of

" De Proprietatibus Rerum "—the famous book written by Bartholomæus Anglicus, says: " In Litargy ouer all thynge the pacyent shall haue a clister." In 1543, Traheron wrote: " A clyster is a noble remedye to dryue out superfluitees of the guttes."

Again, in Holland's translation of Pliny, ii. 413, this passage appears: " If it [sea-water] be clysterized hot, it allaieth the wrings and grindings of the belly." Gatenaria, of Pavia, who died in 1496, designed an enema apparatus, and describes a special syringe as the " instrument of clyster."

Shakespeare, in " Othello," makes Iago say: " Yet againe, your fingers to your lippes? Would they were clister pipes for your sake."

De Graaf, who has already been referred to, devised an important improvement in the technique of administering enemas. In his treatise, " De Clysteribus," which was published in 1668, he commences by saying: " In practising medicine, I have noticed that most of the patients hold lavage in horror only because they are afraid of exposing their fundaments and, consequently, prefer to suffer intolerable gastric and intestinal pain rather than have a lavage and be cured. It is surprising that, as yet, no one has studied the means of giving a lavage to oneself, for the curved cannula which is applied to the syringe is very dangerous, since it is impossible to push the piston without moving the syringe, and without exposing oneself to the danger of wounding the intestine and the rectum, and to make the clyster come out through the sides of the cannula, all the more easily since the patient is obliged to use both hands to manipulate the syringe.

" The apparatus described by Hildanus, to which is attached a cannula, is not convenient, because it is impossible to empty it so completely that none of the clyster remains, and if it is pressed too much, it may become free or burst at the place where it joins the cannula. And since it is necessary to press the vessel

with both hands, the cannula may very easily fall out of the anus.

"As far as I know, up to the present, no other instrument has been used for giving oneself a clyster other than the machine which I have invented, which is such that every one may give himself, or receive from another, a clyster, without fear of exposure or the necessity for changing one's position.

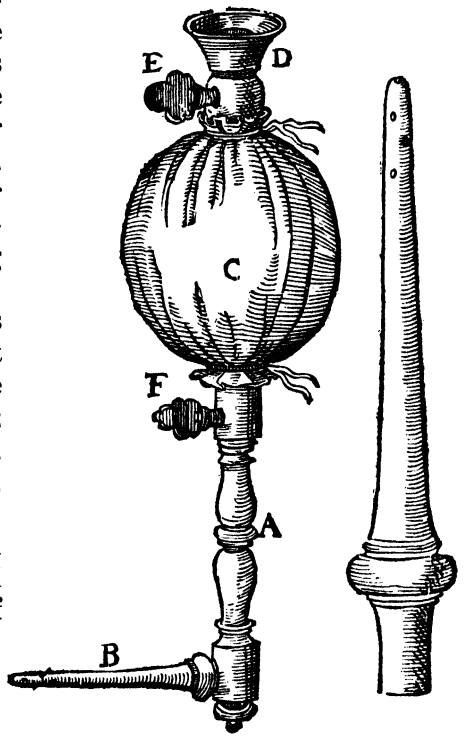

FIG. 1.—The Clyster Apparatus of Fabricus Hildanus.
(*From a drawing made in* 1682.)

"The apothecaries will probably say that to put such a machine into use will ruin them; but, on the contrary, it is to their profit, for, as the lavages will be more in vogue than ever, they will sell greater quantities of their decoctions, and, being no longer obliged to give lavages in cases of dysentery, malignant fevers, and other contagious diseases, there will be less hazard to their lives. But before giving the description of an apparatus so useful to doctors, apothecaries, and patients, it is opportune to explain, first of all, what a clyster is; secondly, who are the inventors of it; thirdly, how many kinds there are; fourthly, what quantity should be used; fifthly, when it should be administered; sixthly, how the patient

should be placed; and seventhly, what benefit is received from them.

"The term is derived from Greek words which mean a lotion and to inject. . . . The word clyster is sometimes used generically for medicamentous injections,

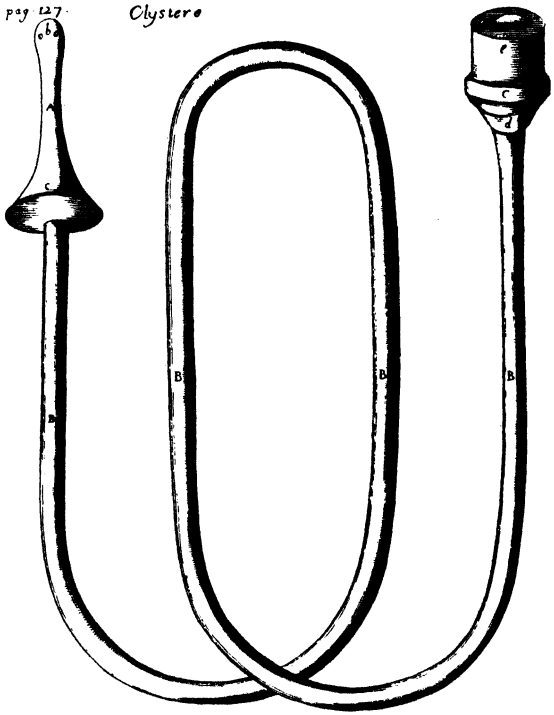

FIG. 2.—De Graaf's Clyster Apparatus.
(*From a drawing made in* 1701.)

which are made into the different cavities, *i.e.*, the ears, the uterus, the penis, and the intestines. But here we are concerned with the latter principally, which is defined as 'a fluid remedy which is injected by the anus into the large intestine.'"

De Graaf gives an interesting description of the apparatus he designed; it consists of a flexible tube

about 2 ells (7½ ft.) long, made of leather or from the intestine of a bird. He depicts the tube as being like the Turkish pipes which are used in England for smoking tobacco. At one end of the flexible tube there is a conical-shaped wooden cannula, with a slightly bulbous, rounded end; two small lateral openings are connected with the central cavity of the cannula. A wooden funnel is attached to the other end of the tube, and into this the nozzle of the clyster syringe is inserted. When the apparatus is to be used, the syringe is filled and the piston pushed downwards, so that the flexible tube is filled with fluid, a little escaping from the end of the cannula. The tip of the anal catheter is then greased with candle tallow, and the end introduced a little beyond the anal sphincters. "The patient holding the syringe on his stomach, pushes the piston with one hand and holds the connection funnel with the other; if desired, the cannula can be given to the patient between two sheets without uncovering him. Then he can easily place it himself, because of the length of the tube, and he tells the apothecary, who holds the syringe out of the bed, when to give the injection, which the patient receives lying on his back, or as he pleases. This method is so convenient that, once patients have taken a lavage in this way, they no longer dread them."

Paré gives these directions for the administration of a clyster: "Whilst the syreage [syringe] is expressed, let the patient hold open his mouth, for by this means all the muscles of the abdomen, which helpe by compression the excretion of the guts, are relaxed. Let him weare nothing that may gird in his belly, let him lye upon his right side, bending in a semicircular figure; and so the Glyster will the more easily passe to the upper guts and (as it were) by an overflowing, wet and wash all the guts and excrements. It hapneth otherwise to those who lye upon their left side; for the Glyster being so injected, is conceived to abide, and (as it were) to stop

in the intestinum rectum, or colon, because in this site these two intestines are oppressed, and, as it were, shut up with the weight of the upper guts. A little while he may lye upon his backe after having received the Glyster, and presently after he may turne himself on either side. And if there be paine in any part, so long as he is able, he may incline to that side. Moreover, because there are many who cannot by any reason bee perswaded to shew their buttocks to him that should administer the Glyster, a foolish shamefastnesse hindering them, therefore I thought good in this place to give the figure of an instrument, with which one may give a Glyster to himselfe, by putting up the pipe into the fundament, lifting the buttockes a little up."

In Bates' "Dispensatory" (1694) the following passage occurs: "You ought to have a short syringe, much like an ear-syringe but much less, and the body of it all of a piece with the spout. Before using it, let the patient make water, if he has occasion, and then exhibit the injection, injecting three syringes full at a dressing, and after, holding the end of the syringe for a minute before you suffer the water to come forth. This ought to be done at first five or six times a day . . . if it be winter time and cold weather, the injection ought to be made blood warm."

It is a surprising fact that many of the South-American Indian races were familiar with the many diverse uses to which caoutchouc could be put, before Columbus discovered America. Baron Nordeskiöld considers that they used enema syringes made of india-rubber at an early date. Syringes of this type which are still used in Guiana and the Amazon district consist of an oval rubber bag with a conical nozzle, rather like a child's squirt.

The introduction of caoutchouc, or india-rubber, into Europe about 1735 led eventually to the adoption of this material in the construction of clyster-pipes, though it

was only about the year 1852 that the Higginson syringe was invented by a surgeon of that name, who was on the staff of the Liverpool Southern Hospital.

It has been recorded that in March 1480 Louis XI. had an attack of apoplexy which nearly caused his death. A physician, Angelo Catho, who was in attendance on His Majesty, prescribed a clyster for him. It is stated that His Majesty's faith in clysters was so profound that he ordered his pet dogs to be treated in this manner on several occasions.

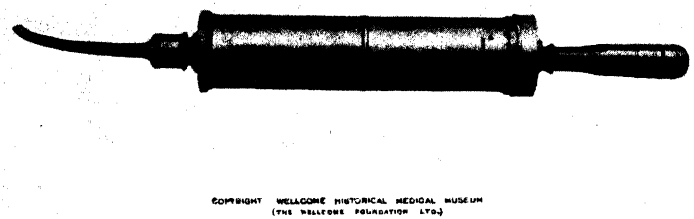

FIG. 3.—A Clyster Pump. French Eighteenth Century.

The use of clysters or enemas became exceedingly common in the seventeenth century. It is recorded that Louis XIII., in one year, had no less than 213 intestinal lavages, and was also venesected 47 times.

Cardinal Richelieu paid Perdreau, his apothecary, for administering 75 clysters in the year 1635 alone.

It was in the early years of the reign of Louis XIV. that the clyster reached the height of its popularity. Society women found that it was an effective method of improving the complexion, and the treatment became a fashionable craze in Paris, many persons having as many as three or four treatments a day.

Molière made great fun of the vogue, and in the last

comedy he wrote, "Le Malade Imaginaire," towards the end of the play the chorus sings—

"Clysterium donare,
Postea saignare,
Ensuita purgare."

Meanwhile the ballet, dressed as apothecaries, make great play with the enema syringes which they carry.

Louis XIV. had over 2,000 injections during his lifetime: in fact, he often received ambassadors and courtiers while seated on his commode. An amusing account has been given of the administration, with suitable pomp, of a clyster to Louis XV. On Friday, 29th April 1774, it was necessary to give the king a lavage. He is dragged over to the edge of his bed with the greatest difficulty, and placed in a suitable position. The Faculty is ranged round him, and makes way for the apothecary, who arrives with the cannula in his hand; he is followed by his apprentice, who carries the body of the syringe most respectfully; after him, comes another boy, with the light destined to illuminate the scene.

During the last decades of the eighteenth century a number of mechanical improvements were made to the clyster syringes: one being the addition of a rack-and-pinion device to the syringe, which increased the power of the apparatus without at the same time interfering with the evenness of its outflow. The clyster chair came into use about this time; it consisted of a wooden bidet, fitted at one end with the fixed clyster pump. The patient sat astride the chair and was personally able to introduce the catheter and make the injection. About this time a number of compact portable instruments were made, which were obviously designed for use when travelling. They generally folded neatly into a small mahogany case.

A little later the gravity irrigator began to come into fashion; with it a greater quantity of liquid could be

used and the pressure be varied as desired. The "fountain syringe," as it was called, became the method of choice in the nineteenth century.

In a book on the use of cold water, written in 1842

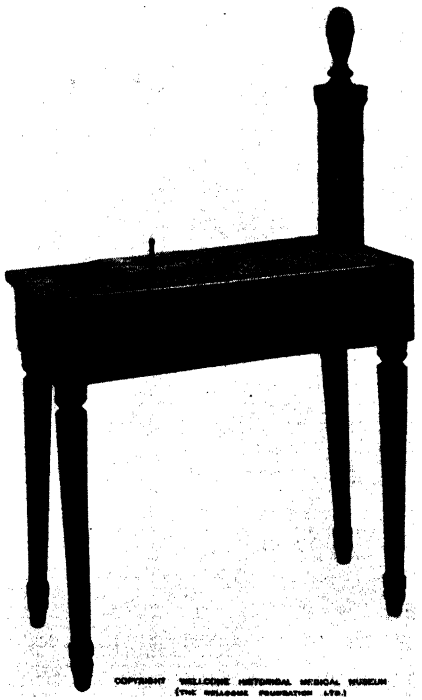

FIG. 4.—The Clyster Chair. French Eighteenth Century.

by Vincent Priessnitz, of Graefenberg, Silesia, the following reference to enemas occurs: "The first and most generally used of cold-water injections are the cold-water clysters, which are used generally for constipation of the bowels and diarrhoea. These diseases are opposites, but both proceed from the same cause—weakness of the intestines—which is remedied by giving tone to these organs and regulating their functions.

At first they must not be applied for more than two minutes; but afterwards, when the intestine is accustomed to them, the clyster will be frequently absorbed, like a glass of water in the stomach. A second clyster is applied directly after the first."

Priessnitz had many followers. A Dr Joel Shaw wrote a treatise on the "Water Cure" in 1847, and in this he states that quart after quart of lukewarm injections may be given until the alimentary canal is thoroughly cleansed. As has already been mentioned, the Higginson syringe was designed about 1854. It is made almost entirely of india-rubber, and is operated by the alternate compression and expansion of the soft rubber bulb. In the original model the bulb was cylindrical, or barrel-shaped. On the Continent it is known as the English syringe.

In a book, "The New Hygiene," written in 1892, the following paragraph appears: "There is a difference between the ordinary injection as used by hydropathic doctors and the new practice of 'flushing the colon.' The former consists of injecting a small quantity of warm water into the rectum or lower end of the colon, washing that out only, while the latter washes out and cleanses the entire colon with from two to four quarts of hot water, and also, when necessary, cleanses the kidneys by retaining a quantity of water in the cleansed colon, until it is absorbed and passes out through the kidneys."

The term "Plombières treatment" has almost become synonymous with colonic lavage in this country, and for that reason it may be of interest to give a brief description of Plombières and the treatment given there.

Plombières is a small town of 2,000 inhabitants, situated in the southern part of the Vosges Department of France. It lies in the valley of the Eaugronne, a small mountain stream which flows from east to west, and is a tributary of the Saône. The altitude of Plombières is 1,400 ft., and it is surrounded by well-wooded hills, which rise to a height of 2,330 ft.

Plombières is the terminal station of a small branch line on the French East Railway. The line runs from Aillevillers, which is a small station on the main Belfort-Nancy line. Plombières possesses twenty-seven hot springs, the hottest having a temperature of 71° C. (159° F.). There are three principal springs :—

The Source des Dames — a clear water, which is tasteless and odourless, but imparts a greasy sensation when it is rubbed between the fingers. The temperature at its source is 52° C. (125·6° F.). Its chemical composition is as follows :—

Per litre.	
Oxygen	1·77 c.c.
Nitrogen	9·62 „
Free carbonic acid	0·01267 grm.
Salicylic acid	0·02734 „
Sodium sulphate	0·09274 „
Ammonium sulphate	0·00007 „
Sodium arsenate	Perceptible traces
Sodium silicate	0·05788 grm.
Lithium oxysilicate	Traces
Aluminium silicate	Traces
Sodium bicarbonate	0·01143 grm.
Potassium bicarbonate	0·00133 „
Calcium bicarbonate	0·03868 „
Magnesium bicarbonate	0·00270 „
Sodium chloride	0·00976 „

The rare gases—neon, xenon, helium, and krypton—are also present and, moreover, the waters, as Curié first showed in 1904, are very strongly radio-active. It is this water which is generally used for colonic irrigation.

The Source du Crucifix.—Water from this spring is very similar to that from the Source des Dames, but it has a temperature of 43° C. (109·4° F.). It is used for drinking purposes.

Source Alliot water is without odour or taste. It

has only 0·1329 grm. of solid ingredients per litre, but contains very small quantities of sodium sulphate, and traces of iron, lithium, and arsenate of soda.

There are seven thermal establishments in Plombières :—

The "Nouveaux Thermes," built in 1857-61 at the suggestion of Napoleon III.
The Stanislas Bath, established in 1882.
The Roman Bath, a semi-underground bath, built in 1882 on the site of the large Roman open-air swimming bath.
The National Bath, completed in 1822.
The Ladies' Bath, which was rebuilt in 1844.
The Capucin's Bath, which is of Roman origin.
The Temperate Bath, which was built in the eighteenth century.

Celtic jewellery and pottery have been discovered at Plombières, showing that the Celts knew of the presence of the thermal springs. The Romans commenced building their baths at Plombières about A.D. 100. They first constructed concrete channels to carry the thermal waters from the springs, and they also procured a supply of cold water from the neighbouring hills. They made extensive excavations, and lined the floor of the cavities with thick layers of concrete. They built seven different baths: a large swimming pool, 134½ ft. by 29½ ft.; three smaller square-shaped baths, one of which was only discovered in 1857; a small circular bath, dedicated to Diana; a hot-air room; and a hot-vapour room which is still used for the same purpose at the present time.

There seems no doubt that the Romans used the baths at Plombières principally for the treatment of their sick and wounded soldiers. After the fall of the Roman Empire, Plombières was sacked and burnt on a number of occasions by the barbarians.

In "De Proprietatibus Rerum," Bartholomæus

mentions the Lorraine thermal baths, so that some of the old Roman baths were evidently in use in the thirteenth century. In the fifteenth century four of the baths were being used, including the large swimming bath, and also a small bath which was used for the treatment of patients suffering from leprosy. In the sixteenth and seventeenth centuries a number of doctors wrote treatises on the waters of Plombières.

In the course of the years, Plombières has had a number of famous visitors, including Stanislas, King of Poland, the Empress Josephine, Napoleon III., James Stuart the Old Pretender, Montaigne, Voltaire, Alfred de Musset, etc. Josephine paid five visits to the town.

It seems probable that one reason that led her to visit Plombières was the fact that the waters enjoyed a reputation for curing sterility. She stayed for several months on her first visit in 1798, and came again in 1801, 1802, 1805, and again in 1809 and 1810. Napoleon III. paid a number of visits to the town between 1856 and 1868. It was here, in 1858, that he met Cavour, and discussed with him the liberation of Italy.

In 1857 a new company was formed under the patronage of Napoleon for the improvement of the resort, and they carried out extensive alterations and rebuilding.

It is impossible to ascertain when colonic irrigation was first introduced at Plombières: preparatory to 1885 the so-called "ascending douche" was used. The patient sat on a water-closet seat, and large quantities of liquid were injected by means of a vertical cannula at an indefinite pressure. Dr Bernard, of Plombières, says: "The method was a brutal one, and was ill-tolerated by the patient." In fact, most of the patients applied the treatment to themselves in their own lodgings.

In 1898 the late Dr de Langenhagen, of Plombières, introduced a new apparatus there, the "douche

horizontale." The distinctive features of the apparatus were that the treatment was arranged to be given with the patient in the recumbent position, hence the name, " douche horizontale," and it was possible with the apparatus to regulate minutely the pressure and the rate of flow of the irrigating fluid. A description of the apparatus will be given in Chapter V.

The term irrigation describes more accurately than the words clyster or enema the treatment which is administered with the modern apparatus. These methods lavage and thoroughly cleanse the walls, remove abnormal mucus, and also empty the bowel. The tone of the colonic muscles is improved and the blood supply augmented.

In regard to more modern apparatus, the Suda-bad subaqueous colonic irrigator was first known as the " Enterocleaner," and was designed by Dr Brosch, of Vienna.

Professor Olpp, of Tübingen, introduced the apparatus into the tropical nursing home there early in 1923, and effected a number of improvements on the original design. The most important of these were alterations to the saddle, the provision of a fæcal reservoir with a revolving sieve, an improved check valve, etc.

Borosini designed his first colonic chair in February 1926. Previously, he had attempted to use the special catheter with the patient seated on an ordinary water-closet. He found, however, that the upright position which this procedure necessitated had many disadvantages, especially the rise in blood pressure which it caused. Another model, incorporating several improvements, was made in 1929, while the latest pattern was publicly demonstrated at the International Congress of Physiotherapy held at Liège in September 1930.

The term " Karlsbad Douche " is often used to describe colonic lavage. Dr Kraus, of Karlsbad, informs me that he believes that colonic lavage was first recommended in Germany by Professor Ismar, of Berlin,

in 1895 or 1896, and that he first saw it used about that time, and introduced it into his own practice at Karlsbad. Water from the " Sprudel " spring is used.

The use of enemas is very common among the primitive races. In Nigeria, a calabash is filled with water, the child is held by the feet, head downwards; the narrow stem of the calabash is then inserted into the rectum, and the contents either allowed to flow into the bowel, or else a calabash with two holes is used and the operator places his lips over this, blows vigorously, and drives the contents of the calabash into the bowel. When treatment is being administered to an adult, the patient bends the body with the head towards the ground. In the Congo the natives administer the treatment to themselves. They lie down on the ground and introduce the perforated tip of a buffalo-horn —which has been filled with water—into the rectum.

CHAPTER II

THE ANATOMY OF THE COLON

In colonic lavage the irrigating fluid only enters the large bowel, as access to the small intestine is prevented by the ileo-cæcal valve, except in certain cases when the valve is not functioning satisfactorily and the fluid is able to pass in the reverse direction through it.

A brief consideration of the anatomy and physiology of the large intestine is essential for an understanding of the mechanism of colonic lavage.

The total length of the large intestine varies between 5 and 5½ ft., which is approximately equal to one-fifth of the total length of the whole intestinal canal. It extends from the cæcum to the anus. It is widest at the cæcum, where its breadth, when moderately distended, is 3 in. It gradually narrows, so that the width of the descending colon is only 1½ in. The rectum is narrowest at its upper part; the lower part, which is known as the ampulla, has a width of about 1 in. when empty, but this is often increased to as much as 3 in. when it is distended.

It is generally an easy matter to identify the large intestine, as it has a characteristic puckered, sacculated appearance, due to the presence of three narrow longitudinal bands of muscular tissue—the tænia coli. These bands are approximately ¼ in. wide, and commence at the base of the appendix; one is situated on the anterior surface, and the others on the postero-external and postero-internal surfaces of the cæcum and ascending

colon. Their positions change on the transverse colon. At the commencement of the rectum, the tænia coli spread out to form a continuous layer of longitudinal muscle fibres.

Small tags of peritoneum containing fatty tissue, known as the appendices epiploicæ, project from the outer surface of the colon. The mucous membrane has a smooth surface and is free from villi, but is studded with numerous glandular orifices.

In the rectum the mucous membrane, however, is arranged in longitudinal folds, and it has a reddish colour, which forms a contrast with the paler yellowish colour of the rest of the large bowel. The glands or crypts of Lieberkühn are straight tubules which lie at right angles to the lumen of the bowel; they contain large numbers of goblet cells. There are also a number of solitary lymph follicles which are most numerous in the cæcum. In the mucous layer there are muscle fibres known as the muscularis mucosa. The submucous layer is formed of areolar tissue. The circular muscle fibres form a continuous layer of the bowel wall, though they are most abundant between the sacculi, and also in the rectum where they form a thick muscular layer—the internal sphincter muscle of the anus. The serous coat of the bowel is complete in the case of the cæcum, transverse colon, and pelvic colon, but the ascending, descending, iliac colon and rectum are incompletely covered. It is extremely difficult to decide what constitutes the normal capacity of the colon, as the elastic walls can be distended. It has been stated that the capacity of the large bowel in infants is 1 pint; at two years of age, $2\frac{1}{2}$ pints; and in the adult, 9 pints. It seems more probable, however, that the capacity of the normal large bowel in the adult is about $5\frac{1}{2}$ pints.

The ileo-cæcal valve forms the point of junction between the small intestine and the colon. The terminal portion of the ileum projects into the lumen of the

large bowel at the junction of the cæcum and the ascending colon.

The valve actually consists of the mucous, submucous, and circular muscle layers. The slit-shaped opening of the valve, which is approximately in the horizontal plane, is bounded above and below by the two lips of the valve. The valve opening runs practically in an antero-posterior direction.

The cæcum is that part of the large bowel which lies just below the opening of the ileo-cæcal valve; it forms a cul-de-sac about $2\frac{1}{2}$ in. in length. The blind end, which generally lies in the right iliac fossa, is directed downwards and inwards. The anterior surface lies above the outer half of Poupart's ligament.

With the exception of the pelvic colon, it is the most mobile part of the large intestine, and is also the most distensible. The three longitudinal muscle bands of the cæcum converge at the base of the appendix, which usually lies about 1 in. below the ileo-cæcal valve on the inner and back part of the cæcum.

The cæcum is nearly always completely covered with peritoneum. It is supplied by the ileo-colic artery, a branch of the superior mesenteric artery. The ileo-colic vein is a tributary of the superior mesenteric vein which unites with the splenic vein to form the portal vein. The ileo-colic lymph glands drain into the pre-aortic glands.

The Ascending Colon is continuous with the cæcum, and commences at the level of the ileo-cæcal valve; it varies from 5 to 8 in. in length. The anterior and lateral surfaces are covered by peritoneum, but the posterior surface is connected by areolar tissue to the iliacus muscle, the quadratus lumborum, and lastly to the lower and lateral part of the right kidney. The hepatic flexure lies between the liver and the right iliac crest, the exact position depending on whether the posture is recumbent or erect.

The Transverse Colon has an average length of

19 to 20 in., which is twice the length of a straight line joining its two extremities. It passes from the hepatic flexure on the outer side of the gall bladder, and passes obliquely upwards and to the left across the abdomen. The position of the transverse colon is greatly influenced by posture, and after defæcation for some time it occupies a relatively low level. The average position, as shown by Röntgen photographs taken in the recumbent posture, is above or on a level with the umbilicus, while it is lower than this when the patient is standing. When the stomach is empty it generally lies behind the transverse colon, but the latter may be pushed downwards and overlapped by a distended stomach.

The transverse colon is attached to the posterior abdominal wall by the transverse mesocolon which covers the pancreas. The peritoneum over the transverse colon meets anteriorly to form the posterior fold of the great omentum. The transverse colon is supplied by the middle colic artery.

The Splenic Flexure.—The phreno-colic ligament anchors the splenic flexure to the abdominal wall. The flexure is in contact with the base of the spleen, and is at a much higher level than the hepatic flexure, and is more deeply situated.

The Descending Colon commences at the splenic flexure and ends at the crest of the ilium, where it is continuous with the iliac colon. It lies at a deeper level than the ascending colon and is considerably narrower, having a width of only $1\frac{1}{2}$ in. It is 4 to 6 in. in length and passes downwards and slightly inwards. In 65 per cent. of cases it has no mesentery—the anterior and lateral surfaces alone being covered by peritoneum, the posterior surface being attached to the posterior abdominal wall by areolar tissue. It is supplied by the left colic artery, a branch of the inferior mesenteric.

The Iliac Colon extends from the crest of the ilium to the inner border of the left psoas muscle and lies in the iliac fossa. It is 5 to 6 in. in length; the lower

part comes in contact with the anterior abdominal wall to the inner side of the anterior superior iliac spine, where it can be readily palpated. In 90 per cent. of cases it has no mesentery. It is supplied by the sigmoid branches of the inferior mesenteric artery.

The Pelvic Colon is continuous above with the iliac colon and ends at the level of the third sacral vertebra, where it passes into the rectum. It forms a freely movable horseshoe-shaped loop, which lies in the pelvic cavity but has no constant position. The convexity of the loop is generally directed to the right. The pelvic colon has a mesentery which is longest at the centre of the loop, where it measures about $3\frac{1}{2}$ in. It is known as the pelvic mesocolon. The pelvic colon may vary in length from 5 in. to as much as 35 in., but is usually about 17 in. long. The centre portion lies between the bladder and rectum in the male, and between the uterus and rectum in the female. It is supplied by sigmoid branches of the inferior mesenteric artery.

The Rectum commences at the level of the third sacral vertebra, and ends by merging into the anal canal by piercing the levator ani muscles at a point $1\frac{1}{2}$ in. in front of, but at a lower level than, the tip of the coccyx. It occupies a fixed position and lies in contact with the sacrum and coccyx, and afterwards rests for about $1\frac{1}{2}$ in. on the lower parts of the levator ani muscles. The rectum is 4 to 5 in. long, and has a diameter when empty of 1 in., but when distended it may have a width of 3 in. The diameter is greatest at the point of junction with the anal canal. It is only partially covered with peritoneum. Where the rectum lies on the sacrum, it forms a curve with its convexity backwards; in the male, at the apex of the prostate, it bends sharply backwards and downwards to join the anal canal. There are also, generally, two or three lateral curves. The cavity of the rectum widens near the point of junction with the anal canal to form the rectal ampulla. The valves of Houston are transverse

folds of the mucous membrane corresponding to the lateral curves. There are generally two valves on the left side of the rectum and one on the right. The rectum is supplied by the hæmorrhoidal arteries.

The Anal Canal commences at the level of the levator ani muscles, where the bowel passes through the narrow space bounded by the mesial borders of these muscles. The anal canal is 1 to 1½ in. long, and is directed downwards and backwards, forming an angle of about 45° with the rectum. At the commencement, the lateral walls of the canal are in apposition, and the slit-like antero-posterior diameter is ½ to ¾ in. The internal sphincter ani muscle is formed of a thickening of the circular muscle fibres of the bowel. The external sphincter of the anus surrounds the lower two-thirds of the anal canal. It arises behind from the ano-coccygeal raphe, and is attached in front to the central point of the perineum. The mucous membrane of the anal canal is ridged in a series of vertical columns, the columns of Morgani, and at the bases of these are the small crescentic anal valves. The lower half of the anal canal is lined with skin. The internal sphincter is an involuntary muscle and probably acts chiefly as a detrusor, assisting in the expulsion of fæces. The external sphincter of the anus, on the other hand, is a voluntary muscle, and is in a state of tonic contraction except during defæcation.

The levator ani muscles also act as sphincters, and they play an important part in supporting the pelvic viscera, including the rectal ampulla. They are voluntary muscles.

CHAPTER III

THE PHYSIOLOGICAL ACTION OF THE LARGE INTESTINE

THE large bowel has three important functions. It acts--

1. As an eliminative organ.
2. As an absorptive organ.
3. In a mechanical way, storing, and at intervals evacuating, the fæces.

1. **The Eliminative Action of the Large Bowel.**—Though considerable quantities of water are absorbed by the large bowel, the fæces normally contain 75 per cent. of water.

The large bowel is the main excretory organ of the body for the elimination of substances which are insoluble or sparingly soluble in water. The principal substances excreted in this way are calcium and magnesium salts, which are present in the fæces chiefly as phosphates, or in the case of calcium sometimes also as calcium soaps. Smaller quantities of sodium and potassium salts are also excreted. Iron occurs in the fæces as iron sulphide, a dark green substance. The heavy metals, such as bismuth and mercury, are excreted by the large bowel. Bismuth colours the fæces black, due to the formation of bismuth sulphide, while calomel produces a greenish coloration, and manganese has a similar effect.

It has been found that when a loop of intestine, which has been carefully cleansed with water, has been

experimentally separated for some days from the remaining parts of the bowel, but with its blood supply left undisturbed, matter which was indistinguishable from normal fæces has appeared in the loop. This experiment shows that a substantial fraction of the fæces is derived from the intestinal wall, and it seems probable that all the protein matter present in the fæces comes from this source. Considerable quantities of fæces are often passed during fasting.

Mucin and nucleo-protein are normally secreted by the intestinal glands in substantial amounts; they lubricate the colon and act as an adhesive for the purpose of binding together the contents of the bowel to form the normal stool. Certain unabsorbed residues of the intestinal secretions occur in the fæces—erepsin, invertase, and amylase are sometimes present in small amount, also bile constituents—taurine, cholalic acid, glycerine, and stercobilin, which give the fæces their characteristic colour. Appreciable amounts of cellular debris from the walls of the large intestine are also present.

It has been found that the fæces contain a very large percentage, often 50 per cent. or more, by weight, of bacteria, which are mostly dead. Strasburger found that approximately 128,000,000,000,000 bacteria are excreted in the fæces in a day. If an ethereal extract is made of the dried fæces, it contains lecithin, cholesterol, fatty acids, and soaps; it is probable that these substances are derived from the intestinal bacteria.

The bacteria present in the large bowel cause nitrogenous matter to undergo putrefactive changes; indol and skatol, which give the fæces their characteristic odour, are formed, also a number of gases, including sulphuretted hydrogen, methane, carbon dioxide, nitrogen, and hydrogen; guanin and adenine are also probably formed in the same way.

The fæces contain varying quantities of undigested and indigestible matter, cellulose forming the greatest proportion; but fragments of elastic tissues, keratin

and tendon, also sometimes occur. There is, normally, very little undigested protein, but greater quantities of undigested fat are generally present.

Certain vegetables, fruits, and fruit juices colour the fæces. Spinach and blackberries have this effect, and certain red wines. Further reference is made to this subject in Chapter IV.

2. **The Absorptive Action of the Colon.**—The substance which is chiefly absorbed by the large bowel is *water*, the average amount being 400 c.c. (14 oz.). The fæces, however, contain water ; the percentage varies considerably, and is lowest when constipation is present and there is delay in the passage of the fæces through the large bowel.

Various salts can be slowly absorbed in the cæcum and colon, the degree of absorption depending on their tonicity.

Glucose is absorbed by the large bowel, as it is known that the small quantities which pass the ileo-cæcal valve are absent from the fæces. It is thought that fats are absorbed in the same way in the cæcum, also their derivatives—glycerine, fatty acids, and soaps. Seven-eighths of the bile salts (sodium glycocholate and taurocholate) are absorbed by the bowel. It seems probable that a certain proportion of some of the gases which are formed in the large bowel are absorbed, and act on the nerve cells in the bowel wall ; carbon dioxide, methane, and sulphuretted hydrogen most likely operate in this way.

There is a divergency of opinion as to whether proteins are absorbed by the large bowel, but probably small quantities are.

When intestinal stasis is present, toxic absorption takes place, and indol, skatol, and phenol are each found in a combined state in the urine. It is probable that other end-products of putrefaction are absorbed in a similar manner.

Nerve Supply.—The colon, like the stomach and

small intestine, has a double nerve supply; but in spite of this fact, the large intestine can function more or less adequately without the aid of the central nervous system.

Fibres from the sacral cord pass in the pelvic nerves to the large intestine and rectum; they end in Auerbach's plexus, collections of neuro-muscular nodal tissue which lie between the two muscular coats of the bowel. These nerves, which have no connection with the sympathetic system, fulfil the same function in the case of the colon as do the branches of the vagi which supply the stomach and small intestine. The tone of the colonic muscles is enhanced by stimulation of these nerves, and more vigorous movements take place, though momentarily the movements are inhibited if peristalsis is present immediately prior to the application of the stimulus.

The sympathetic fibres supplying the large bowel come from the lower lumbar region of the spinal cord, pass through the sympathetic cord to the inferior mesenteric plexus where their cell station lies, and thence to the colon and rectum. Stimulation of these splanchnic nerves lessens the tone of the colonic muscles and inhibits their movements. It also produces vaso-dilatation and an increased secretion of watery succus entericus.

3. **The Mechanical Action of the Colon.**—This action consists principally in the storage of the fæces and their evacuation at intervals, in other words, the reception and discharge of waste material which is unusable. It may also act as a temporary reservoir for water.

Peristalsis was first seen in the intestines of animals when the abdomen had been experimentally opened. The movements were found to take place even though the extrinsic nerves had been sectioned, but painting the surface of the intestine with a solution of cocaine or the injection of nicotine caused the immediate cessation of the movements. It seems,

therefore, that the phenomenon is a reflex action, controlled by the cells of Auerbach's plexus lying in the intestinal wall. The various stimuli which cause peristalsis to take place can be local or referred. They may be mechanical, thermal, or chemical. Stimuli conveyed from other parts of the alimentary canal, and emotional influences, can also affect peristaltic movements.

Peristalsis is produced primarily by the rhythmical contraction of the circular muscular fibres of the intestine; the impulse seems to pass from cell to cell, and normally takes place in one direction only.

Experiments have been carried out in which a section of intestine has been isolated and sutured in the reverse direction. Intestinal stasis resulted with distension of the bowel in the area proximal to the resected portion. The constricted area of the bowel during the passage of a peristaltic wave is preceded by an area of relaxation which aids the onward progression of the contents of the intestinal canal. The peristaltic waves in the small intestine travel about 1 in. a minute. Hurst found that the average time taken by the contents of the small intestine to travel the $22\frac{1}{2}$ ft. from the pylorus to the terminal part of the ileum was three and a half hours, which is $6\frac{1}{2}$ ft. per hour, or $1\frac{1}{4}$ in. per minute.

Peristalsis, besides propelling the contents of the bowel onwards, also stimulates the flow of blood through the intestinal vessels and assists the portal circulation. Normally, peristalsis does not produce any conscious impressions; when it is excessive, however, considerable pain may be experienced. Groups of contraction waves, followed by periods of relaxation, cause the paroxysms of colic. Peristalsis in the large intestine takes place at a much slower rate than in the small; in fact, the fæces take longer to travel from the cæcum to the splenic flexure—a distance of about 2 ft.—than they do to pass through the whole $22\frac{1}{2}$ ft. of the small intestine. Great light has been thrown on the movements of the large

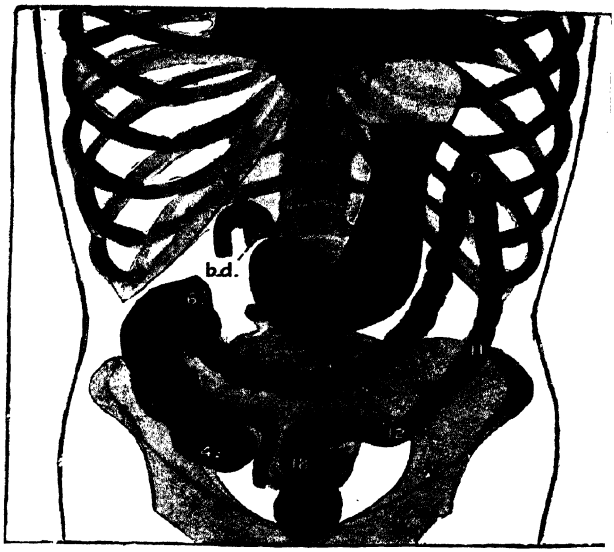

FIG. 5.—Appearance with Subject in the Erect Position.

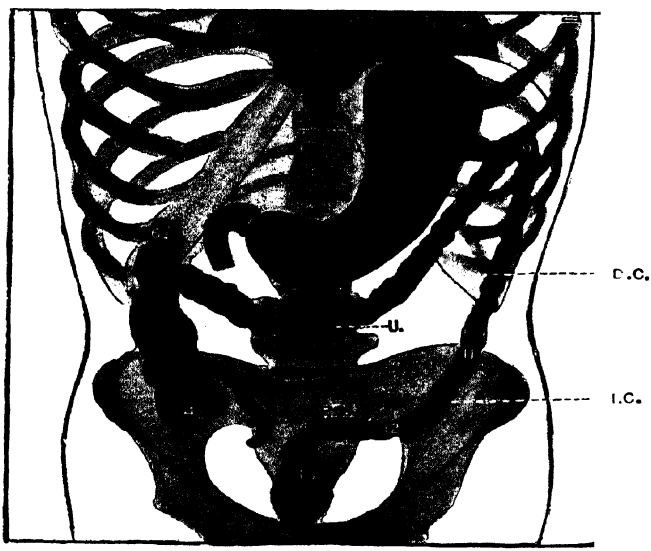

FIG. 6.—Appearance with Subject in the Recumbent Position.

Composite drawings, showing the average rate at which food passes through the normal alimentary tract. The numbers represent the hours taken by the Bismuth meal to reach the different parts of the colon. (*After* Hurst.)

(*By Permission of Oxford Medical Publications.*)

bowel by the Röntgen-ray examination of the alimentary tract after the ingestion of a bismuth or barium meal. Hurst found the average time for the shadow to appear in the cæcum was four hours, and that the fæces reached the hepatic flexure in six and a half hours, while nine hours were required to reach the splenic flexure, eleven hours the commencement of the iliac colon, and twelve hours the pelvic colon.

Segmentation.—Apart from peristalsis, other movements take place in the small intestine; they only occur when the bowel is distended by masses of food. Segmentation was first demonstrated by Cannon, who used Röntgen rays for the purpose; the phenomenon can be seen most easily in the duodenum and the terminal part of the ileum. The shadows appear rather like a string of sausages, then, suddenly, constrictions appear in the centres of the food masses, and these become deeper until, finally, the masses are completely divided at these points. Meanwhile, the old divisions have disappeared, owing to the junction of the halves of the segments. Hurst found that in man these divisions occurred about every nine seconds. The movements are rhythmical in character, and appear to be due to contractions of the circular muscle fibres. They obviously aid the digestion and absorption of the food, as they promote the thorough mixing of the food with the different digestive juices. They also assist absorption. Segmentation movements help to pump the blood from the submucous venous plexus into the inferior mesenteric vein, and probably they assist the passage of chyle from the lacteals into the larger lymph vessels.

Antiperistalsis.—Habitual antiperistaltic waves occur in the ascending colon and cæcum; they do not take place when the ileo-cæcal valve is open. They commence at the centre of the transverse colon and slowly travel to the cæcum. The waves are generally shallow in character, and usually there are six waves a minute;

regurgitation of the fæces into the small intestine is prevented by the ileo-cæcal valve. Antiperistalsis aids the absorption of water and nutrient matter.

Mass Peristalsis.—The movements of the large bowel differ considerably from those of the small. For some time after the introduction of the bismuth-meal method of examining the alimentary tract with Röntgen rays, no movements were ever seen to occur in the colon. In the small intestine, on the other hand, the movements of the intestinal contents were so rapid that it was difficult to view them satisfactorily on the fluorescent screen. However, in 1907, Hurst was examining a patient with the screen when defæcation took place, and the contents of the cæcum and ascending colon moved bodily into the transverse colon, and all the fæcal matter lying beyond the splenic flexure was evacuated. Holzknecht described similar colonic movements, and mentioned the disappearance of the haustral segmentation which took place immediately before the mass peristalsis. He made the suggestion that colonic movements only occur three or four times a day, and that at other times the bowel contents are absolutely stationary. Mass peristalsis occurs when food is taken, or when the bowels are opened, and it does not appear to cause any appreciable sensations. In one of Hurst's cases, a mass passed from the ascending colon to the rectum in three minutes.

Sometimes the colon becomes palpable, and feels like a rigid cord during the peristaltic movements. Tonic contraction of the circular muscle fibres seems responsible for the phenomenon, and the entry of food into the empty stomach undoubtedly provokes the movements. Usually mass peristalsis only leads to the evacuation of the bowels after breakfast, when the passage of fæces from the loaded pelvic colon into the rectum creates the desire for defæcation. Certain individuals, however, experience the desire to empty the bowels after each meal.

Haustral Churning.—Food enters the sacculi of the colon, and certain churning movements have been noted which appear to mix the food in the haustra.

The Ileo-cæcal Sphincter.—When this valve is normal it is not possible for fæcal matter in the cæcum to regurgitate into the ileum. Impulses transmitted by the splanchnic nerves keep the sphincter in tonic contraction; if these nerves are severed, the sphincter immediately relaxes. The valve prevents the chyme from leaving the ileum too quickly. The terminal portion of the ileum plays a very important part in the digestion and absorption of food. Food reaches this part of the small intestine at least an hour before it passes through the valve into the cæcum: during this time, segmentation takes place very actively.

Peristaltic waves occur in the terminal part of the ileum most frequently when food is being taken, and immediately after a meal. This gastro-ileal reflex causes filling of the cæcum to take place. The swallowing of food and its entry into the stomach reflexly cause active peristalsis in the ileum and relaxation of the ileo-cæcal valve. The cæcum remains empty, except perhaps for a little gas, until four hours or so after the first meal of the day. Then, however, chyme commences to pass through the ileo-cæcal valve, and characteristic sounds can then be heard with the stethoscope over the cæcum: these sounds usually continue for one to two hours. The fluid chyme is squirted through the valve at intervals and gradually fills the cæcum from below upwards. Absorption of fluid takes place rapidly, and the cæcal contents become more solid in character. In the transverse colon the fæces become firmer, but further changes in their consistency do not take place until they reach the pelvic colon. The entry of food into the empty stomach also provokes mass peristalsis in the large bowel, to which reference has already been made. It is known as the gastro-colic reflex.

The Different Stimuli of Colonic Contraction and Relaxation.—These stimuli can be classified in the following way :—

1. Thermal stimuli.
2. Chemical stimuli.
3. Mechanical stimuli.
4. Central nervous system reflexes.

1. **Thermal Stimuli** may be either direct or indirect. It is possible to produce direct stimulation of the colon by means of an enema. One can employ enemas of widely differing temperatures, but the range of those below the body temperature which can be used is very much greater than those above ; for instance, ice-cold water can be used at a temperature about 98° F. below body temperature, but the range of solutions hotter than 99° F. is considerably smaller. Cold solutions increase peristalsis and, if too cold, can produce colic. Hot solutions, on the other hand, have a sedative effect, and allay colonic movement. Indirect thermal effects are seen when fluids are taken by the mouth, cold water stimulating intestinal movements ; very hot water also provokes peristalsis, but to a much smaller degree. Heat applied to the abdominal wall, either in the form of radiant heat or conductive heat, when the agent is in contiguity and where heated water, vapour, air, or other thermal-conducting substance may be employed, lessens intestinal peristalsis. A cold-water douche to the abdomen, on the other hand, provokes bowel movements.

2. **Chemical Stimuli.**—It is almost impossible to determine whether various substances influence intestinal movements by a direct local action on the mucous membrane of the bowel, or whether the effect only takes place after they have been absorbed. Chemical stimulation is less marked in the colon than in the small intestine, as by the time the food residues reach the large bowel, almost all the material which could be absorbed has disappeared. A vegetable diet has much

greater effect in producing intestinal movements than a meat one. A large number of different substances stimulate intestinal movements. These may be the products of digestion or of bacterial action. Certain products of protein metabolism, such as amino-acids and peptone, may have a feeble effect on peristaltic movements; oils and fats are definitely stimulating, as also are their metabolic products—soaps, glycerine, and fatty acids.

Sugars stimulate the movements of the small intestine. Certain acids which are present in fruits—and which may also be formed by bacterial action, such as acetic, butyric, citric, lactic, and tartaric acids—are powerful stimulants. Carbon dioxide, sulphuretted hydrogen, and marsh gas, all increase peristalsis. Bile stimulates peristalsis also, but only in the large intestine. The secretions of the thyroid and pituitary glands increase intestinal movements, and this probably explains why diarrhœa is such a common symptom of exophthalmic goitre, and constipation of hypopituitarism and hypothyroidism. Experimentally, it has been found that extracts made from the tissues of the small intestine, when injected, increase peristalsis. These glandular substances which are present in the blood probably act on Auerbach's plexus.

Cathartics, such as castor oil and cascara, produce their effect by acting as irritants to the mucous membrane of the bowel wall.

Inhibitors of Intestinal Movements.—Oxygen inhibits intestinal movements, and the secretion of the suprarenal glands has the same effect, probably by stimulating the sympathetic system. When the inhibitory action of the sympathetic nerves supplying the gastro-intestinal tract is curtailed or completely arrested, as occurs in Addison's disease or after excessive smoking, diarrhœa or even enterospasm may occur.

3. **Mechanical Stimuli.**—Distension of the bowel by gases, fluids, or solids is the principal mechanical

stimulus of intestinal movement. It is also possible that the variations in intra-abdominal pressure which occur during exercise may stimulate peristalsis.

Gases such as carbon dioxide, methane, etc., act powerfully in this way, and they may also have a chemical action when they are absorbed. When the colon is distended by an enema, the colonic muscles react to the stimulus, and active contractions take place. This action is often seen after a barium enema has been administered: normally, the enema flows by hydrostatic pressure into the cæcum; sometimes, however, especially when the quantity or the pressure at which it is introduced is too great, colonic contraction takes place. The opaque fluid is compressed by the contracting muscle so that it is squeezed away from the constricted area in both directions, some passing in a proximal direction towards the cæcum, and the other in the reverse direction towards the rectum. Hurst has found that when the quantity is more than $1\frac{1}{2}$ pints, or the pressure is more than $1\frac{1}{2}$ ft., contraction of the colonic muscles is induced. The movements are generally intermittent in character.

Solid matter in the bowel, such as indigestible and undigested food, also causes distension of the colon and, therefore, contractions. Cellulose is uninfluenced by the human digestive juices, and consequently it forms the largest proportion of indigestible matter in the bowel; it is present in the greatest quantities in the fæces of those taking a vegetarian dietary.

4. **Central Nervous System Reflexes.**—These can be either stimulating or inhibitory. Contractions of the intestinal muscles can be caused by the pleasurable anticipation of food, the smell or sight of food being sufficient to evoke this reaction. The effect which swallowing has on intestinal movements, and the gastro-ileal and gastro-colic reflexes have already been mentioned. Excitement and pleasant emotions can also stimulate bowel movements, while pain, fear, and

anger may lead to either their inhibition or stimulation.

Defæcation.—*The Stimuli*—A variety of stimuli can produce the desire to empty the bowel, the commonest, perhaps, being the taking of the first meal of the day—breakfast. The entry of food into the empty stomach provokes the gastro-colic reflex, and active peristaltic movements take place in the large bowel. Normally, except actually during defæcation, the rectum is empty, as the fæces are prevented from passing further than the distal end of the pelvic colon by the pelvi-rectal flexure, and also because of the tonic contraction of the circular muscle coat at this situation. The peristaltic movements taking place in the large bowel may drive some of the fæces which have collected in the pelvic colon into the rectum. This causes the rectum to become slightly distended, and the call to defæcation generally results. Other stimuli which can have the same effect are: a glass of cold water taken before breakfast, the change of posture entailed by getting out of bed, and the movements which take place during washing and dressing—especially if a cold bath is taken. The rectum, as Hurst has pointed out, is insensitive to tactile and chemical stimulation, and the mere contact of the fæces with the rectal mucous membrane is insufficient to produce the desire to empty the bowels.

It can be shown experimentally that distension of the rectum will produce the call to defæcation. The introduction of a small balloon attached to a manometer and pump is the simplest method of demonstrating this. It has been found that if the balloon is inserted into the lower part of the pelvic colon and slowly filled with air, a sense of fullness is experienced just above the symphysis pubis. When the balloon is withdrawn a little, and inflated below the pelvi-rectal flexure, the feeling of fullness is noticed in the rectum. The rectal ampulla is very susceptible to distension, and the call to defæcation is produced by a very moderate inflation,

the call becoming more urgent the greater the degree of distension. There is evidence that the tone of the rectum gradually relaxes with sustained distension, and that the urge to defæcation may pass away until the intra-rectal pressure is increased. It is probable that this is the reason why the call to defæcation disappears if it is not responded to soon after its onset, though the absorption of water from the fæces which causes a reduction in their bulk also plays a part.

The actual emptying of the bowel is normally under voluntary control, and the action is brought about chiefly by the marked rise in intra-abdominal pressure which follows the contraction of the diaphragm and the muscles of the abdominal wall. At the commencement of defæcation, a deep breath is taken and the breath held by closure of the glottis; the diaphragm is then maintained in its position of maximum contraction, the muscles of the abdominal wall are contracted, and if the ideal squatting position is adopted, the thighs are pressed against the abdominal wall and the spine is flexed; meanwhile the levator ani muscles contract and prevent the intra-abdominal pressure from falling. The contraction of the diaphragm depresses the transverse colon and the hepatic and splenic flexures; the lower border of the cæcum, however, only moves downwards about $\frac{1}{2}$ in., so that the ascending colon is compressed downwards into the cæcum, the two becoming almost spherical in shape. The descending and ascending colon soon return to their original position, but the transverse colon rarely returns to the position it occupied immediately before defæcation until an hour or more later. Keith found that the intra-rectal pressure in a person at rest in the erect position was about 25 mm. of mercury, but that during defæcation the pressure rose to between 100 and 200 mm. of mercury. More fæcal matter is driven into the rectum by the raised intra-abdominal pressure, and vigorous contractions of all the colonic muscles take

place; at the same time, the two sphincter muscles of the anus relax. The levator ani muscles raise the anal canal and draw it over the fæces, and then they contract strongly and expel the fæcal remnants.

Results of Injuries or Disease.—Defæcation can still take place though there may be severe injury or disease of the cord; as, however, the call to defæcation is not felt, voluntary aid is generally lacking. When the rectum becomes filled with fæces, contractions of the colon take place, and the fæces are expelled. Constipation is, however, generally present in these cases, as the fæces tend to become excessively hard, owing to the abnormal absorption of water which takes place. If the spinal cord is diseased or injured above the lumbar region, the centre for the external sphincter muscle of the anus which lies in the conus terminalis is undamaged, and the tone of the muscle is not affected, though it is not possible to check voluntarily the passage of fæces through the anal canal when the rectum is emptying.

If the conus terminalis is damaged, complete relaxation of the sphincter results.

CHAPTER IV

THE FÆCES, AND THE FLORA AND PARASITES OF THE INTESTINE

The bacteria which are present in the alimentary canal are, strictly speaking, actually outside the body. The conditions in the large intestine are extremely favourable to bacterial growth: the temperature is the optimum for many species; a considerable variety of food material is available, and there is adequate moisture. Bacterial growth is most luxuriant in the cæcum and ascending colon, owing to the large quantity of water which is mixed with their contents. In their passage through the colon, the fæces become more and more solid, owing to the absorption of water, and consequently the conditions become increasingly less favourable for the growth of bacteria. Diet has a considerable influence on the intestinal flora. Animal protein encourages the growth of putrefactive bacteria, and the larger the amount of animal protein in the dietary, the greater the degree of intestinal putrefaction. It is possible to determine the extent of intestinal putrefaction by estimating the amount of indol and indican present in the fæces and in the urine. Animal protein has been found to produce eight times as much indol as a vegetable diet. A diet rich in carbohydrates generally leads to the replacement of the putrefactive bacteria by the fermentative group. Raw starch, dextrin and lactose are valuable for this purpose, lactose being more slowly absorbed than the other sugars.

The acids produced by the saccharolytic action of

the bacteria, besides arresting the growth of the bacteria of putrefaction, also stimulate intestinal movements and aid frequent defæcation.

Vegetable proteins and fat do not have any effect on the intestinal flora. The gastric juice normally exercises a strong bactericidal effect, and in consequence the contents of the stomach are sterile. In the hypochloridia which is associated with pernicious anæmia, however, this is not the case, and various intestinal organisms, especially *Bacillus welchii*, are markedly increased. Intestinal stasis leads to an increase in the number of organisms present in the bowel. The meconium passed by the new-born child is sterile, but it has been found that in summer bacteria can be found four hours after birth, and in winter the meconium contains bacteria twenty hours after birth. The *Enterococcus* and *Staphylococcus albus* are generally the first organisms to be found. Later, coliform bacilli appear, and frequently *B. putrificus*: these are generally followed by *B. bifidus*.

While the infant is being fed at the breast, 90 to 95 per cent. of the intestinal flora consists of *B. bifidus*; the fæces of the artificially fed infant, however, contain a number of different organisms, including *B. welchii* and *B. sporogenes*.

Fasting has been found to cause a decrease in the bacteria found in the upper parts of the colon.

The intestinal flora can be divided into four groups :—

1. The coliform group of gram-negative bacilli.
2. The gram-positive aciduric group of bacilli.
3. The gram-positive streptococci.
4. Aerobic and anaerobic spore-bearing organisms.

1. **The Coliform Group** provide the majority of the organisms found in the fæces of the adult. The *B. coli*, which is the commonest of this group, is present in the alimentary tracts of practically all warm-blooded animals; these bacteria are decreased in numbers

by the adoption of a lacto-vegetarian dietary. Other members of the group are the *B. communior*, *B. acidi lactici*, *B. lactis aerogenes*, and *B. cloacæ*; sometimes Morgan's bacillus, *B. proteus*, and *B. pyocyaneus* are also found.

2. **The Aciduric Group of Gram-positive Bacilli.**—The two organisms forming this group are the *B. bifidus* and *B. acidophilus*. As has already been mentioned, *B. bifidus* forms up to as much as 95 per cent. of the intestinal bacteria of a breast-fed infant. *B. acidophilus* is not found in the stools during the first few years of life, but only occurs in the fæces of older children and adults. These organisms only cease growing when the concentration of acid in the medium exceeds 1 per cent., whereas *B. welchii* cannot survive an acid concentration greater than 0·16 per cent. A medium containing 1 per cent. of sugar causes putrefactive flora to be replaced by aciduric bacteria. A temperature of 98·6° F. is the optimum one for the growth of *B. acidophilus*, which is non-pathogenic, being solely a saprophyte.

B. bulgaricus is not a normal inhabitant of the bowel, and it has not been found possible to implant it successfully therein.

3. **The Gram-positive Cocci.**—These organisms are all members of the non-hæmolytic group of streptococci, and it is probable that the *Enterococcus*, the *Streptococcus fæcalis*, and the *Micrococcus ovalis* are different forms of a common type. These organisms increase in numbers when additional amounts of glucose or cane-sugar are added to the diet.

4. **The Aerobic and Anaerobic Spore-bearing Organisms.**—The aerobic group include *B. subtilis*, *B. mesentericus*, *B. megatherium*, and *B. mycoides*; they all have a strong proteolytic action, and possibly assist in the breakdown of undigested food residues.

The commonest anaerobic spore-bearing organisms found in the fæces are the proteolytic *B. sporogenes*,

and the aciduric *B. welchii*, but a number of other organisms have been found in the fæces of people in good health. These are the aciduric organism *B. tertius*, the proteolytic *B. putrificus*, also *B. histolyticus*, *B. tetanoides*, and *B. tetani*. Certain spirochætes, also various moulds and yeasts, are sometimes found.

The Function of the Intestinal Bacteria.—Contrary to the view put forward by Pasteur, the intestinal bacteria are not essential to life; they probably do render service, however, by splitting up material which has been unaffected by the digestive juices, converting it into a form which can be absorbed.

Certain non-pathogenic organisms produce conditions in the intestine which lead to the suppression of putrefactive bacteria.

Cultures of various organisms have, at different times, been used for this purpose—*B. lactis aerogenes*, *B. bulgaricus*, and later, *B. acidophilus*, which is now the organism most frequently employed to produce an acid reaction in the intestine.

Pathogenic Organisms found in the Intestinal Canal in Different Diseases.—Bacterial food-poisoning is generally caused by one of the following bacteria: *B. aertrycke*, *B. botulinus*, *B. enteritidis* of Gaertner, or *B. suipestifer*.

Other organisms which are found in the fæces in certain diseases are *B. typhosus* and *B. paratyphosus* A and B in typhoid and paratyphoid fevers. These organisms are present in the excreta in 33 to 50 per cent. of cases, and may be found from the first week onwards. Carriers of these diseases may pass the organisms for prolonged periods, though apparently in normal health.

In acute cases of dysentery it is generally possible to find the *B. dysenteriæ* of either the Shiga-Kruse or Flexner-Y types. The Shiga-Kruse type produces a severe condition, but, fortunately, a satisfactory standard serum is available; the Flexner-Y type of organism causes milder symptoms, but there is no standard

serum. The Sonne bacillus has also been found to produce dysenteric symptoms. The staphylococcus is not a normal member of the intestinal flora, and if it is found, there is probably an abscess in the rectum or anal canal.

Certain varieties of hæmolytic streptococci and *Streptococcus viridans* can become pathogenic.

Tubercle bacilli are only found in the fæces when there is considerable intestinal involvement.

The presence of *B. fæcalis alcaligines* in the stools is not considered of importance.

Intestinal Parasites.—Certain *amœbæ* are found in the intestinal canal: two are harmless, *Entamœba coli* and *E. nana*; the third, *E. histolytica*, is the cause of amœbic dysentery.

There are several flagellates which sometimes occur in the human intestine, *Giardia intestinalis* being the type most frequently found. It appears to be pathogenic in only 10 per cent. of the cases in which it occurs. *Chilomastrix mesnili* and *Trichoma hominis* are also sometimes seen.

Balantidum coli is the commonest of the ciliates to be isolated from the human fæces, and occasionally it is present in cases which have the symptoms of chronic dysentery. The eggs of *Distoma hepaticum*—a species of trematode or fluke—are also sometimes found. The commonest of the tape-worms are *Tænia saginata* (the beef tape-worm), *T. solium* (found in pork), and the fish tape-worm, *Bothriocephalus latus*. The discovery of segments of the tape-worm in the fæces is the method of diagnosis; an average segment of *T. saginata* is 16 mm. long by 5 mm. broad, and of *T. solium*, 10 mm. long by 6 mm. broad; with *Bothriocephalus latus*, however, it is customary to find numbers of ova.

Several different round-worms (*Nematoda*) can inhabit the human intestinal canal: they are *Ascaris lumbricoides*, the common intestinal round-worm; *Oxyuris vermicularis*, the thread-worm; *Trichocephalus dispar*,

the whip-worm; and *Ankylostoma duodenale*, which produces the most severe symptoms. Both the worms and the ova of *Ascaris lumbricoides* are passed, and more than one parasite is generally present in the intestine. There is usually a considerable number of thread-worms present in infected cases, and auto-infection is very liable to take place. This frequently happens also in the case of *Trichocephalus dispar*: the ova of this parasite are oval and have brown shells. The diagnosis of ankylostomiasis is made by finding the ova, which are generally numerous, in the fæces. *Trichoma spiralis* is another parasite which occurs in the alimentary canal, though only in a sexually mature form.

Examination of the Fæces.—Certain important information can be obtained in regard to a specimen of fæces by a naked-eye examination.

Attention should be paid to—

1. The quantity of fæces passed daily.
2. Their form and consistency.
3. Their colour.
4. Their odour.
5. Any abnormal ingredients which may be present.

The *quantity* of fæces passed daily depends in a great measure on the dietary, the amount being greatly increased with a vegetarian diet. The average weight, on a mixed diet, is considered to be about 4 to 5 oz.; on a vegetarian diet it is about twice this amount.

The *consistency* of the stools may vary a great deal; in diarrhœa they are generally more fluid than normal, and are often watery. Hard stools are frequently found in constipation. The normal stool is semi-solid and sausage-shaped; in constipation the fæces often become globular in shape, like marbles. Ribbon-shaped stools are often found in cases where the lumen of the large intestine is partially obstructed at one place. Sometimes a large hæmorrhoid or polypus in the rectal

region grooves the stool. Stools which are unduly buoyant in water contain large quantities of gas.

The *colour* of the stools is principally due to a pigment which is derived from bile, stercobilin. The colour normally varies from a yellowish brown to dark brown, being lighter when a milk diet is being taken, and darker on a flesh diet, owing to the presence of hæmatin and its derivatives. As has already been mentioned, different foodstuffs and medicines influence the colour of the fæces. Stools with a tarry appearance contain altered blood, which has probably come from the upper part of the small intestine; they generally have an offensive smell. Stools the colour of white clay are found in cases of biliary obstruction. Unaltered bile pigment is often found in diarrhœa, when the intestinal contents traverse the canal in an unduly short time.

The *odour* of the fæces is mainly due to skatol and indol; the odour of the stools of a person taking a lacto-vegetarian diet is rather different, and is of a sour character, due to the presence of volatile acids.

The *reaction* of the fæces varies, but it is generally alkaline; the motions of a baby at the breast are acid.

When the fæces of a person on a mixed diet are placed on a fine sieve and thoroughly washed with running water, fragments of various indigestible foodstuffs, such as seeds, stones, and fruit and vegetable skins, are found. If an excessive amount of mucus is present in the fæces, it can be isolated in this way. Greyish-white strings, flakes, and casts of the bowel are found in the stools of a patient suffering from muco-membranous colitis. Certain abnormal food residues are occasionally present in the fæces, which can be revealed by microscopic examination. A large amount of undigested connective tissue indicates an impairment of gastric digestion, as the gastric juice alone acts on this substance. Nucleated muscle fibres reveal an entire absence of pancreatic digestion, while sago-like grains of undigested potato may denote certain

disorders of the small intestine. Foreign bodies which have been accidentally swallowed, also gall-stones, intestinal sand, parasites, and the eggs of parasites, are sometimes discovered.

Microscopic examination of a small portion of the fæces will reveal pus in cases where there is an inflammatory condition of the colon.

The Chemical Examination of the Fæces.—Chemical examination of the fæces is carried out most frequently for the purpose of determining whether they contain occult blood. The presence of blood mixed with mucus signifies organic disease of some portion of the alimentary tract. When this blood is altered so that the corpuscles cannot be identified by microscopic examination, the hæmorrhage has probably taken place somewhere in the stomach or small intestine.

When bleeding has taken place from hæmorrhoids, the blood is bright red in colour, and it generally forms a streak on part of the surface of the motion. The blood in cases of colonic cancer is generally found to have a jelly-like appearance, owing to the admixture of mucus. The fæces in ulcerative colitis contain large quantities of mucus, with blood adhering to the surface of the mucus.

The most accurate test for occult blood is the benzidine test, but this test is so sensitive that it is essential for the patient to adopt a milk-farinaceous diet for several days before it is carried out. A small portion of the fæces, about the size of a pea, is carefully mixed on a glass slab with some glacial acetic acid, and some ether is added. One or two drops of tincture of benzidine and of a solution of hydrogen peroxide are then added to the extract. If the blood is present in the fæces, a deep blue coloration will appear.

It is sometimes necessary to estimate the amount of *bile* present in the fæces. The test for bile pigments most frequently performed is Gmelin's test, in which some crude nitric acid is added to a mixture of fæces and

water; rings of different colours, yellow, red, violet, and green, reveal the presence of bile pigments. In complete biliary obstruction, no stercobilin is present in the fæces. In catarrhal jaundice there may be, for a time, very little. The spectroscope can also be employed for the examination of the fæces for stercobilin. In diarrhœa, bile pigments and stercobilin may be both present together in the fæces, as the intestinal contents may have reached the anal canal with too great a speed for conversion of all the bile pigments to take place.

Tests for *fæcal fats* are sometimes carried out for the purpose of estimating the ratio of unsaponified fatty acids to fatty acids in the form of soaps. The ratio between neutral fats, free fatty acids, and soaps varies in certain different diseased conditions where the fats are imperfectly split up, and in others where the absorption of fats is abnormally low. In cases where there is a deficient quantity of pancreatic juice reaching the intestinal canal, the quantity of unaltered, neutral fat in the fæces may be greatly increased, and large numbers of colourless droplets may be seen under the microscope. When, however, there is solely a decrease in the bile, the quantity of neutral fat is rarely increased, but the free fatty acids and soaps are present in large amounts. In cœliac disease, sprue, and cases where there is obstruction to the lymphatic circulation of the mesentery, there is an imperfect absorption of the food fats which have, however, been broken down.

The results of an examination of the fæces can be tabulated in the following way:—

Examination of Fæces

Name	*Laboratory No.* .....
From	*Specimen received* .....
Colour	*Consistency* .....
Odour	*Mucus* .....
Reaction	*Bile* .....
Blood (occult)	

Microscopic Examination

Ova.....
Protozoa.....
Blood cells.....
Pus cells.....
Fat.....
Striped muscle fibre.....
Starch (undigested).....

Cultural Examination

Aerobic.....
Anaerobic.....

Remarks.....

CHAPTER V

COLONIC LAVAGE APPARATUS

THE apparatus which was used for colonic lavage in earlier times has been described in Chapter I. Perhaps the most widely known of the modern lavage apparatus is the horizontal douche, which was introduced at Plombières by De Langenhagen.

It consists of a couch fitted with adjustable back and foot rests, and having in the centre a circular opening which is placed above a specially shaped water-closet. The insulated cylindrical container has a capacity of 10 litres (2·2 gals., 17·6 pints). It has two lateral socketed projections on each side, which engage on two vertical rails, one of which is measured off in centimetres, the point O on the scale being on a level with the top of the couch. The container is suspended by a flexible wire, which passes over two pulleys, and is either counterweighted or controlled by a windlass, which allows its height above the couch to be varied. The container is fitted with a water-level gauge, calibrated in tenths of litres (approximately in divisions representing 100 c.c.), and it has a sensitive thermometer attached to it which registers from 0° to 80° C. The inlet pipe is connected with the hot and cold water supply, and the container itself is used as a mixer. The outlet opening of the container is connected by a length of india-rubber tubing, with a horizontal pipe which runs along the wall about 1 ft. above the upper level of the couch. It is fitted with a separate pressure control lever and a tap which can be turned on and off. The

operator is thus able to regulate minutely the rate of flow of the irrigating fluid into the bowel, while the patient can arrest the flow when desired. The quantity, temperature, hydrostatic pressure, and rate of flow of the irrigating fluid are thus under perfect control.

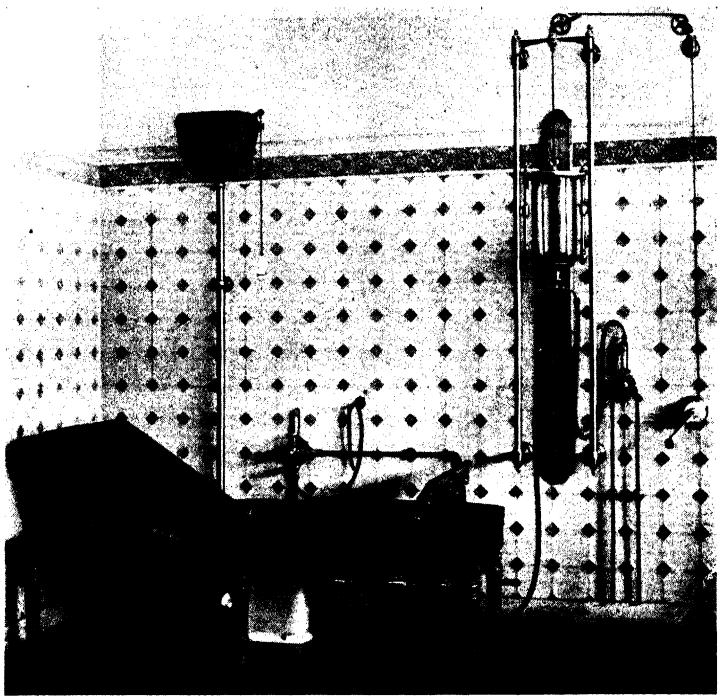

FIG. 7.—The Plombières "Douche Horizontale." (E. Guesnier, Paris.)

A special supple catheter of red india-rubber, known as "canule entero-balnea," is used. It is made in three sizes—

No. 1.—25 cm.	long	and	7 to 8	mm.	in diameter.
No. 2.—30 „	„		8 to 9	„	„
No. 3.—35 „	„		9 to 10	„	„

The end of the catheter is hemispherical, and 5 mm. from the tip there is a pear-shaped opening, 15 by 7 mm.,

which leads obliquely into the lumen of the catheter. On the opposite side of the catheter, 34 mm. from the tip, there is an oval opening, 10 by 5 mm. The reason for having the two openings is, that if it should happen that one orifice became plugged with fæces, the other would probably remain free. The catheter widens out at the other end and has an outside diameter of about 18 mm.

An attempt will now be made to describe some of the other modern methods which are now available.

A. Low irrigation.
B. Methods of high irrigation in which an attempt is made to pass a tube into the cæcum.

Another division which can be made is—

1. Those methods which make use of a catheter through which the irrigating fluid both enters and leaves the body by the same channel.
2. Catheters which have separate inlet and outlet channels.
3. And those which only have an inlet channel and yet which remain *in situ* throughout the treatment.

The Schellberg methods employ high irrigation and make use of long colonic tubes. The average length of the Schellberg colon tube is 54 in., and the Vattenborg 30 in.

The other methods, such as Austin's irrigators, the Springfield Infirmary apparatus, Stephen's anal tube, the Studa and Suda apparatus catheters, and the Borosini catheter, make use of short, rectal catheters, which only penetrate into the rectal canal for a few inches.

The Schellberg, Honsaker, and Vattenborg apparatus are designed so that the irrigating fluid enters, and the effluent leaves, through the same tube passage way.

Other appliances, such as the J.B.L. apparatus, are

only used to introduce the irrigating fluid into the bowel, and are removed as soon as this is accomplished.

Stephen's anal tube and Austin's irrigators, on the other hand, have separate passages for inward and outward streams, while the Springfield Infirmary apparatus, Studa chair, and Borosini apparatus catheters are designed solely to introduce the irrigating fluid into the bowel, but are so arranged that they remain firmly *in situ* throughout the administration of the treatment, evacuation taking place around them, without dislodging them.

The rectal catheter is the essential part of the apparatus, but it is also necessary to have a reservoir, with satisfactory means of support. A couch or chair is also required and a receptacle for the effluent.

Catheters.—The normal *Schellberg Catheter* for adults is formed of pliable red rubber, 54 in. long and 50 French gauge. The tip is conical and bullet-shaped, the end is pliable enough to bend fairly freely, though the body of the tube is more rigid. There is an oval, rounded opening 1 in. from the end of the tube.

The Honsaker Colon Tube has been designed to project the irrigating fluid forwards and to prevent the mucous membrane from being sucked into the eyes of the tube during the withdrawal of fluid from the bowel. Part of the wall of the tube is absent for 1 in. from the rounded tip, exposing the cavity of the tube for this distance.

The Vattenborg Catheters are 30 in. long, and vary from 28 to 32 French gauge. They have a closed end and two or more apertures opening from the central cavity of the tube. The colon tube is introduced into the bowel by passing it through an anal applicator; this applicator is made of metal, and is so shaped that once it has been introduced the sphincter muscles retain it *in situ*. The colon tube is much smaller in diameter than the applicator, which has a large return chamber at its base, fitted with a lateral outlet tube.

The Austin Irrigator is made of vulcanite, and its free end is roughly ovoid in shape and about 3 in. in length and $\frac{3}{8}$, $\frac{1}{2}$, and $\frac{5}{8}$ in. in thickness. The inlet tube is placed at a right angle to the long axis of the catheter, and is smaller in diameter than the straight outlet tube. The diameter of the catheter is greatest where the inlet tube joins it. The incoming fluid passes through a number of small openings at the proximal end of the bulbous portion of the catheter. The outlet opening is in the central long axis of the irrigator.

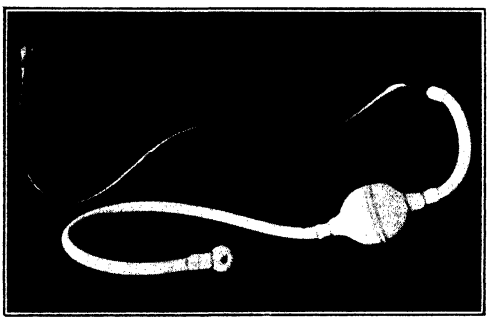

FIG. 8.—The Catheter of the Springfield Infirmary Apparatus with Higginson Syringe attached.

The Springfield Infirmary Apparatus consists of a plated brass tube 22 in. long, bent so as to adapt itself to the conformation of the perineal region. The olive-shaped tip is removable, and several different sizes are available.

The external diameter of the tube is 10 mm. and the internal 7 mm. The end of the tube to which the rubber tube is attached forms a handle 3 in. long by being at right angles to the main axis of the tube.

Stephen's Anal Tube is like a rectal speculum in appearance; it is made of nickel and is chromium plated. An obturator is placed in the tube while it is being inserted, and afterwards withdrawn. The diameter of the catheter is increased by extending the hinged portion

of the catheter. The catheter is designed to allow it to have a wide outlet tube.

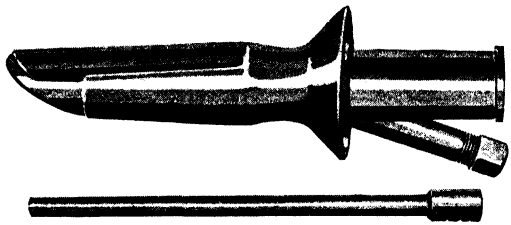

FIG. 9.—The Stephen's Analtube (closed).

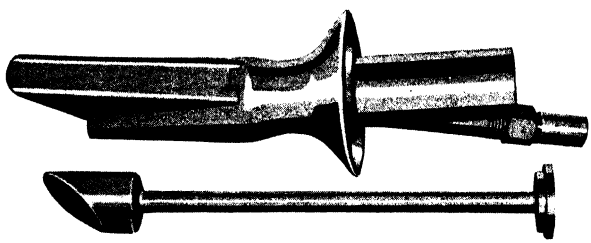

FIG. 10.—The Stephen's Analtube (open).

The Studa Chair Catheter is L-shaped, the shorter limb being in the vertical plane when the catheter is in use, while the horizontal limb is 7 in. long.

There is a ball-and-socket joint at the junction of the horizontal and vertical limbs. The internal diameter of the vertical tube is 5 mm., and the external 6 mm., but this expands to nearly 12 mm. at the joint.

The terminal part of the catheter is detachable and can be unscrewed, this allows rectal tubes of varying length to be used; their usual length is $3\frac{1}{4}$ to $3\frac{3}{4}$ in. however.

The distal end of the vertical tube is closed and dome-shaped. There are four oval openings 8 mm. long on the lateral part of the tube, commencing 4 mm. from its tip.

The ball-and-socket joint allows the rectal tube to be moved through an angle of 65°.

The Borosini Catheter is distinctive in that it is made partly of rubber and partly of metal. It consists of a horizontal tube 5 in. long, curved at one end, which has another curved tube joining with it on its upper surface about $1\frac{1}{3}$ in. from its free end; the outlet of this curved tube lies parallel to it and in the same vertical plane. There is a two-way tap at the point of junction of these two tubes.

A rubber catheter $4\frac{1}{2}$ in. long, and with an external diameter of 9 mm., is attached to the other end of the horizontal tube. This has one terminal and two lateral openings, and its axis makes an angle of 120° with the horizontal tube.

Projecting backwards and downwards from the horizontal tube is a metal hook. When the catheter is in use, the irrigating fluid enters through the curved metal tube if the tap handle is in the vertical position; when, however, the handle is placed in the horizontal position, no fluid can enter the catheter, but fluid can flow straight outwards from the rectal canal.

Two small metal loops are attached to the sides of the curved metal tube about 1 in. from its tip. To these loops and to the metal hook tapes are fastened, which are used to fasten the catheter in position in the rectum.

The new model of the Borosini catheter differs considerably from the original pattern. It consists of an S-shaped tube. From a point about 1 in. from the tip of the front part of the catheter, a tube $1\frac{3}{4}$ in. long projects forwards, and at the junction there is a two-way tap. A short rubber tube is attached to the rectal end of the catheter, and it curves upwards and forwards to make an angle of 65° with the horizontal part of the instrument. Detachable rubber tubes of different lengths can be used. A metal limb 4 in. long, which curves backwards and downwards, is attached to the under surface of the horizontal part of the catheter, and fixed to the tip of this, and lying at right angles to it, there is

a grooved rod 3 in. in length, into which a rubber band fits when the catheter is in use.

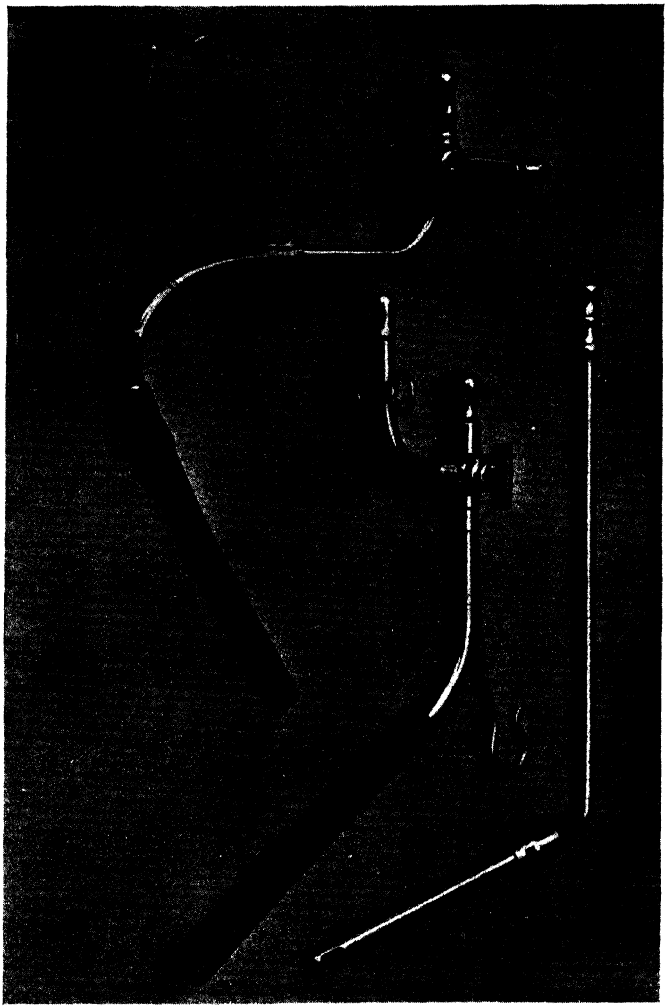

FIG. 11.—Catheters used for Colonic Irrigation. The Studa Chair catheter is on the left, while the other two are used with the Borosini (Gymnacolon) apparatus, the improved model being on the right.

In the *Subaqueous Intestinal Lavage Apparatus* the rectal catheter is similar to that of the Studa apparatus,

but its long limb is attached to the centre part of the special saddle; this will, however, be described later.

Certain of the catheters which have been described can be used on an ordinary closet. This applies to the Springfield Infirmary apparatus, Austin's irrigators, etc.

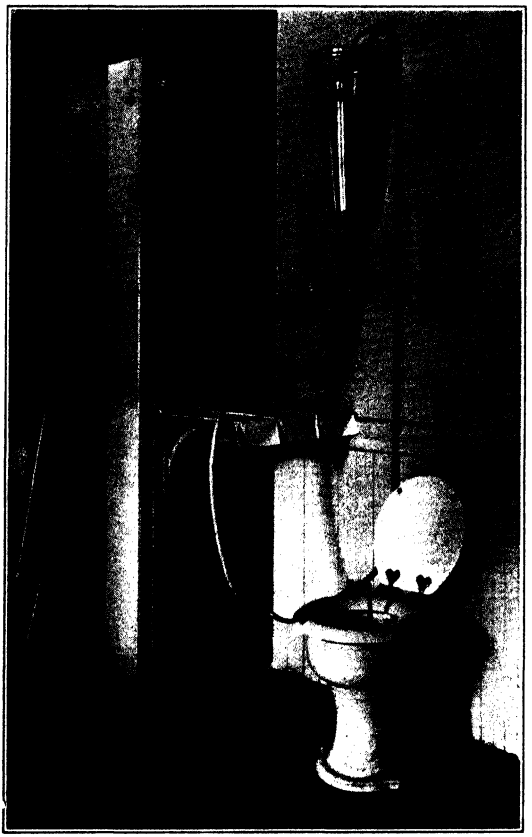

FIG. 12.—The Hospital Type of Springfield Infirmary Apparatus.

The Springfield Apparatus, portable model, obtains its supply of irrigating fluid by means of a Higginson syringe, which has its free end placed in a bowl of water. The hospital model has a glass reservoir with a capacity

of 3 gals.; this is generally suspended 7 ft. above the floor. Stephen's anal tube and Austin's irrigators can be used in the same way, though the latter is provided with an india-rubber bag reservoir.

The Vattenborg Apparatus is a mobile unit, and is generally used with the patient lying on a surgical couch or hospital bed.

The Honsaker Apparatus has certain special features. The couch is a plain one, 64 in. long, 26 in. wide and 28 in. high. Projecting vertically upwards from the floor at the foot of the couch are three $\frac{3}{8}$-in. chromium-plated pipes, one a waste pipe and the others the hot and cold water supply. The water pipes open into an oblong metal mixer which has a capacity of 1 quart. The mixer has a circular opening fitted with a screw cap, and medicaments such as oil or acidophilus cultures can be introduced into it. The graduated 3-gal. percolator made of glass is placed above the mixing chamber through which the water passes to fill it. The rate of outflow from the percolator can be minutely adjusted. The directional control is fitted on a movable arm which rests just above the level of the couch. The operator is able to regulate the control in a very simple manner. The position of the control handle determines whether the fluid flows from the percolator into the bowel or from the patient into the waste pipe; or the connections with the patient can be closed, and the percolator allowed to empty through the waste pipe. The directional control can also be arranged to produce a suction effect for the removal of gas from the bowel. The control can be very easily detached for sterilisation.

The Standard Schellberg Apparatus has a specially designed metal table to which all the other parts of the apparatus are connected. A cylindrical glass bowl 12 in. in diameter is arranged under the centre of the table. This is fitted with a 2-in. movable valve, which allows the effluent to be retained in the bowl for as long as is desired. When the valve is open, there is direct connec-

tion with the trapped soil pipe. Underneath the table and placed on a swinging arm there is an aluminium drainage bowl, which is also connected with the soil pipe. The effluent pipe discharges into this.

The table itself is 6 ft. by 1 ft. 8 in., and is 2 ft. $10\frac{1}{2}$ in. high. The middle third of the upper part of the table is formed of wood and has an oval opening 10 by 8 in., the long axis being at right angles to the long axis of the table. The upper third of the table is covered by a waterproof cushion, and the lower third has an aluminium foot-plate attached to it. Attached to the table is a second swinging arm, which supports the three-way valve at a height of $7\frac{1}{2}$ in. above the table top.

Three tubes fitted with taps carry the irrigating solutions to a single tube which opens into the valve, and from it there are two outlets, one carrying the irrigating fluid into the colonic tube and the other a return tube, allowing the effluent to run out from the colonic tube into the aluminium drainage bowl. Both this bowl and the glass bowl have a flushing system derived from the water main.

The three percolators or reservoirs for the irrigating fluids are attached to a swing bracket at the foot of the table, and their height can be adjusted. When the percolators are full, the water level is roughly $3\frac{1}{2}$ ft. above the couch level when they are at their highest position, and $2\frac{1}{2}$ ft. when at their lowest position. The large percolator is 12 in. deep, and the smaller ones 10 in. deep. The percolators are graduated glass vessels, two having a capacity of 2 quarts, and the other of 2 gals. They are fitted with metal covers in which are fixed metal funnels with hinged lids, to facilitate the introduction of fluid without removing the large cover. In each percolator there is an electric bulb heating element, and also a thermometer graduated from 0° to 100° C. and filled with a red indicating fluid, which makes it easy to read the temperature at a glance. The

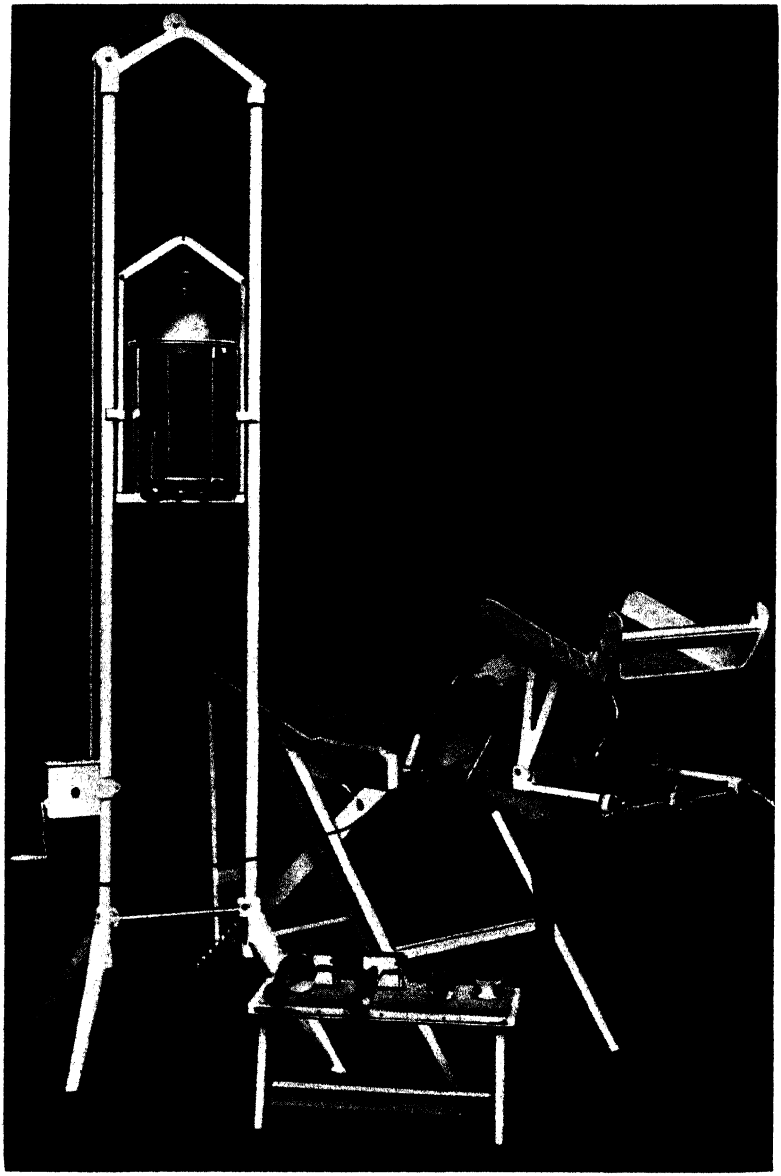

FIG. 13.—The new Model of the Gymnacolon Apparatus.

outflow from the vessels passes through india-rubber tubes. In the case of the 2-gal. tank, a special glass

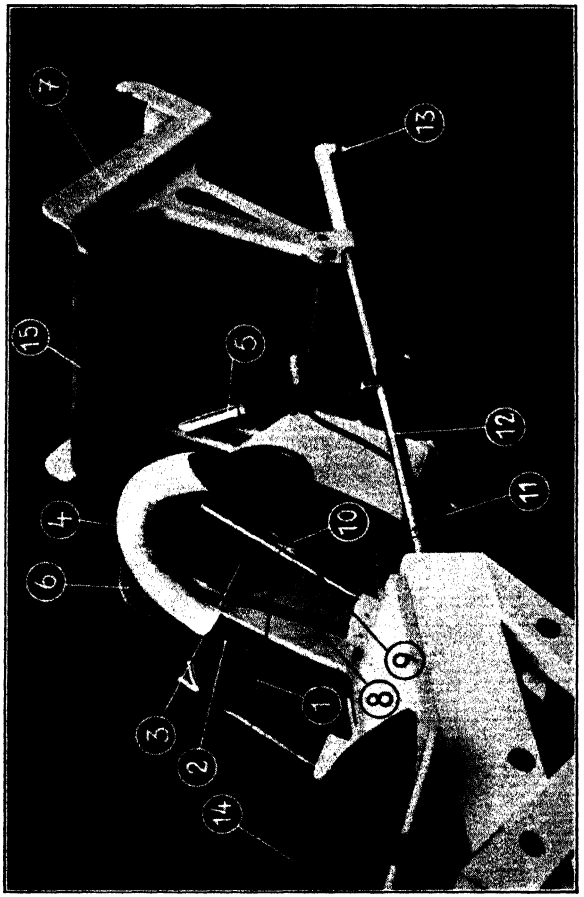

FIG. 14.—Detail of the Gymnacolon Apparatus, showing the Fæcal Funnel, Leg Rest, etc.

valve is interposed. This valve automatically stops the flow when the intra-colonic pressure reaches a certain strength. The fluid entering the valve passes through a narrow hook-shaped glass tube, which projects the incoming stream upwards into the main chamber of the

valve. It can at once be seen whether the water is flowing through the valve.

A small pair of steps is provided with the apparatus to enable the patient to climb on to the table.

The Borosini Apparatus has recently been redesigned and improved, and the new model, therefore, will be described. It consists of a wooden couch, the back part of which can be adjusted. The centre of the couch is horizontal and covered by a thick pad of sponge rubber. The rim of the effluent funnel is inclined at an angle of 120° to the centre portion of the couch. At the base of the funnel is a movable scoop, which can be used for collecting specimens of the effluent.

Two small inspection chambers, fitted with transparent windows, are arranged in the funnel, and on one side there is an electric lamp which illuminates the inside of the funnel; on the other there is an adjustable mirror which enables the patient to see the interior of the funnel. Two stout metal rods are attached to the centre part of the couch and project horizontally forwards. A movable and adjustable foot-rest is fixed to these. The effluent funnel is also movable along these rods. It can be placed over a fæcal bucket or attached to the soil pipe. The reservoir is of 6-gal. capacity and is fixed in a metal cradle, which is supported by a lofty metal stand. By means of a windlass and pulleys the height of the tank can be perfectly regulated. The tank is made of nickel and is fitted with level gauge, thermometer, and outlet control.

The Studa Chair consists of a wooden arm-chair fitted with an adjustable back and having a foot-rest. There is a circular opening in the seat of the chair communicating with a metal, horn-shaped cloaca, to the narrow end of which the fæcal conduit is attached. This is fitted with a glass inspection chamber, so that the material passing down the conduit can be readily seen. The conduit terminates in the fæcal container,

where there is a revolving strainer which allows a close examination of the fæcal residues to be made. It is fitted with a water spray. The fæcal container is

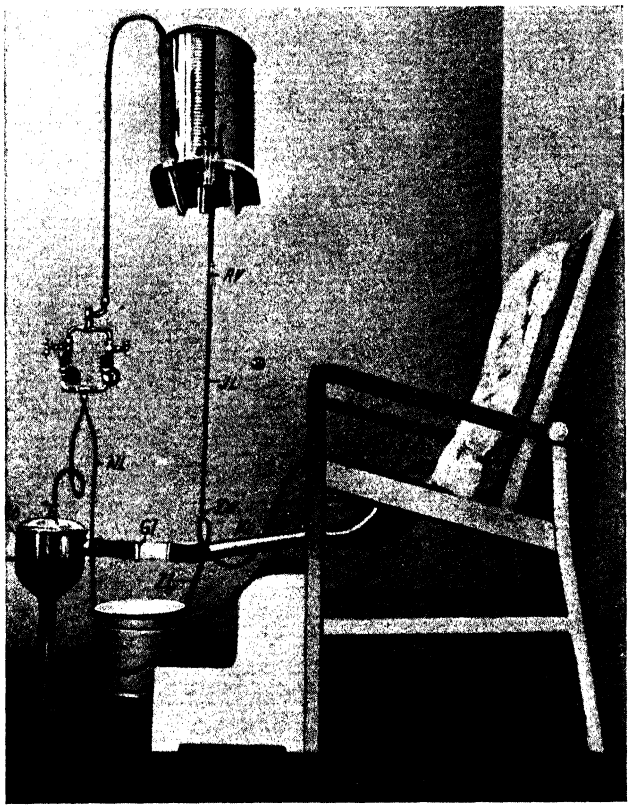

FIG. 15.—The Studa Chair Apparatus.

connected with the soil pipe by means of a trap. The irrigating fluid is stored in a tank of 8-gal. capacity, which can be filled with hot or cold water from a specially arranged supply system fitted with a small mixer.

The tank is generally placed on a wall bracket, the base being placed 3 ft. above the chair seat. The tank has a thermometer attached to it, and also a glass water-

level gauge. A pressure control chamber at the base of the tank regulates the flow of fluid, and there is a medicament funnel for introducing medicaments into the irrigating fluid at any period during the treatment. Rubber tubes connect the main water supply with the fæcal container, and also the cloaca, so that these can readily be flushed out with hot or cold water when desired. A rubber-ring cushion, which is fitted with a rubber sleeve, rests on the seat of the chair and surrounds the cloacal opening.

The Subaqueous Intestinal Bath is the most elaborate apparatus for colonic irrigation which is available. It is made by the firm which makes the Studa chair apparatus, and, in consequence, many of the parts of the apparatus are duplicated.

The distinctive feature of the Subaqueous intestinal bath, as the name implies, is the fact that the colonic irrigation is carried out while the patient is lying in a bath. The bath should be a large, comfortable one, and should have an internal length of at least 6 ft. It should be installed in a commodious, well-ventilated treatment room, and should be arranged so that the foot of the bath is against one of the walls, while the head projects into the centre of the room and allows free access to the head and both sides of the bath.

The taps are most conveniently placed at one side of the bath, as the fæcal container and the special overflow pipe are placed at the foot of the bath, and the head support at the head.

On the Continent it is customary to use the apparatus in an ordinary domestic bath, but that is not permissible in this country, and a special trapped connection with the soil pipe must be installed.

The irrigating tank is generally placed on a wall bracket 5 ft. above the level of the bottom of the bath.

A mixing valve, with hot and cold water supply, is fixed to the wall at the foot of the bath, and water at

the required temperature is available for the purpose of supplying—

1. The bath.
2. The irrigating tank.
3. The subaqueous abdominal douche.
4. The perineal spray attached to the saddle.
5. The spray in the lid of the fæcal container.

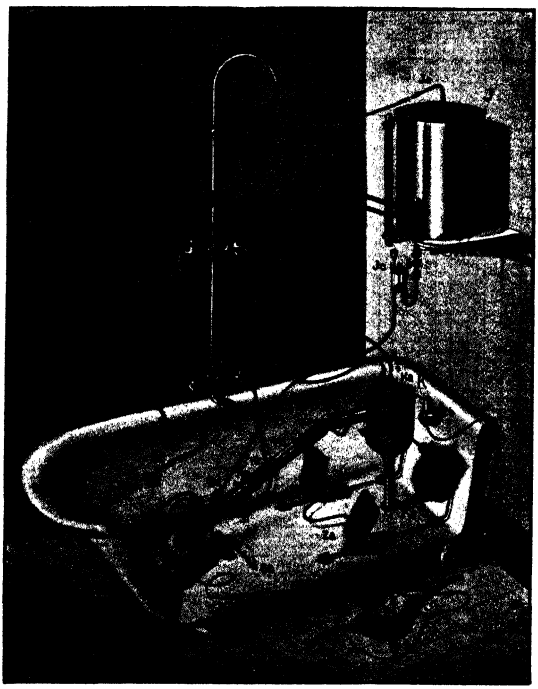

FIG. 16.—The Subaqueous Intestinal Bath Apparatus.

The treatment room should be equipped with a wash basin, an examination couch, a steriliser 18 by 10 in. and 9 in. deep, and a large cupboard for the storage of spare parts, drugs, etc.

A special saddle is fitted to the patient's buttocks. This saddle carries the small rectal catheter and also a much wider outflow tube. The saddle, which is

made of metal and rubber, is rather like a bedpan, and it is fitted with a rubber cushion which can be inflated with air, so that the device fits very evenly against the patient, preventing any escape of fluid or gas. Another tube connects the saddle with a mixer, which communicates with the hot and cold water supplies, so that it is possible to douche the perinæum with hot or cold water when desired.

The saddle has on its under surface three india-rubber pads, which distribute and support the patient's weight

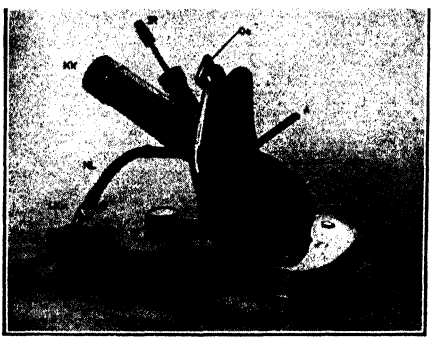

FIG. 17.—The Saddle of the Subaqueous Intestinal Bath Apparatus.

during the administration of the treatment and maintain the saddle at the correct angle. Two flexible aluminium plates encased in rubber, which can be moulded round the hips, and rubber straps fasten the saddle to the patient. The bath is fitted with a head-rest and an adjustable foot-rest.

The outflow from the fæcal funnel is fitted into the lower waste-pipe outlet in the bath. There are a number of perforations at the lower end of the fæcal conduit leading from the fæcal container, and the conduit is fitted with a small hinged lever which, when it is turned downwards, allows the bath to empty. The lever has to be turned upwards during irrigation when fæcal effluent is flowing through the conduit, so

COLONIC LAVAGE APPARATUS

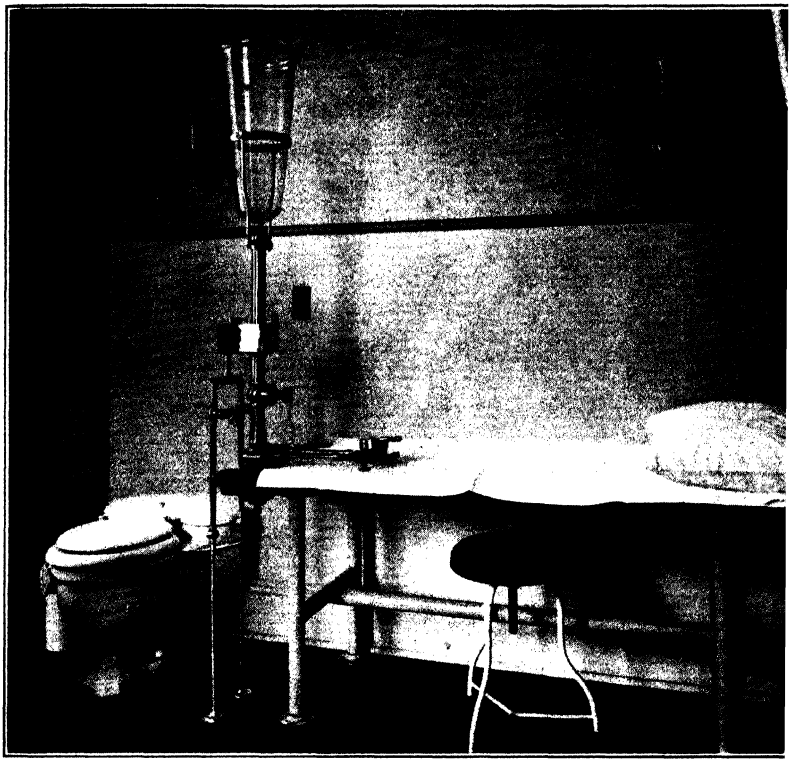

FIG. 18.—The Honsaker Colonic Lavage Apparatus.

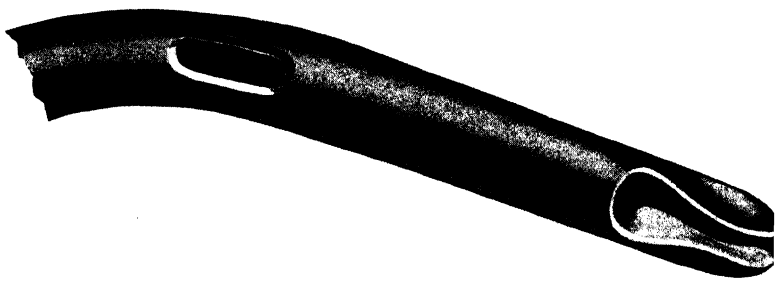

FIG. 19.—The Honsaker Colon Tube.

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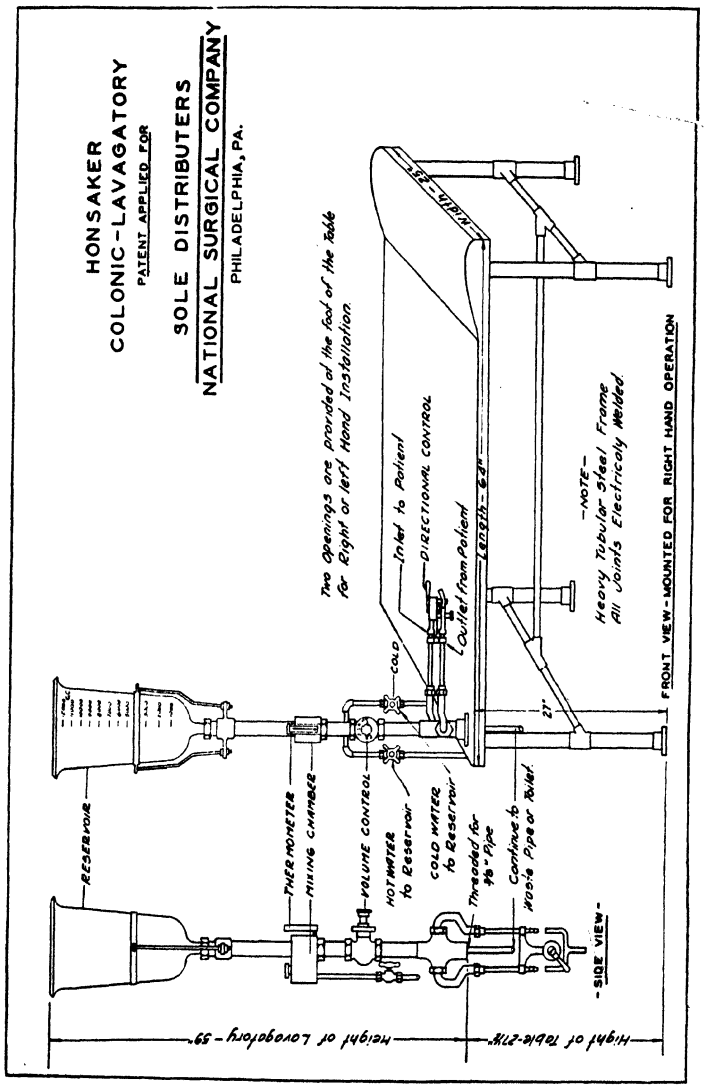
INSTALLATION DIAGRAM
HONSAKER
COLONIC-LAVAGATORY
PATENT APPLIED FOR
SOLE DISTRIBUTERS
NATIONAL SURGICAL COMPANY
PHILADELPHIA, PA.
Two Openings are provided at the foot of the Table for Right or left Hand Installation
Inlet to Patient
DIRECTIONAL CONTROL
Outlet from Patient
Length - 84"
RESERVOIR
THERMOMETER
MIXING CHAMBER
VOLUME CONTROL
HOT WATER to Reservoir
COLD WATER to Reservoir
Threaded for ¾" Pipe
Continue to Waste Pipe or Toilet
COLD
21"
-NOTE-
Heavy Tubular Steel Frame
All Joints Electrically Welded
FRONT VIEW - MOUNTED FOR RIGHT HAND OPERATION
- SIDE VIEW -
Height of Lavatory - 39"
Height of Table 27½"

FIG. 20.

that the perforated portion of the tube is then inserted into the waste pipe, and contamination with the bath water is prevented.

From the mixer it is customary to have another rubber tube with a rose attached to its end, so that under-water douche massage can be applied to the abdomen. In the Subaqueous intestinal lavage apparatus, the saddle and, therefore, the rectal catheter are at a lower level than the fæcal container, and the effluent matter has to be forced upwards by the contraction of the muscles producing defæcation. The fæcal conduit is fitted with a sliding tube device, which allows the length of the conduit to be quickly adjusted when required.

CHAPTER VI

DIFFERENT METHODS OF ADMINISTERING COLONIC IRRIGATION AND THEIR TECHNIQUE

A Comparison of the Different Types of Colonic Lavage Apparatus.—The different methods of colonic lavage can be grouped in a number of ways, depending on whether a long or short tube is used, or the method may be one in which a single injection only is possible each time the catheter is inserted into the bowel, or continuous irrigation may be an essential part of the process. Catheters for continuous irrigation may have an inlet tube only, or they may have both inlet and outlet openings. In the Plombières method (*douche horizontale*) the colon tube is withdrawn when the required amount of fluid is introduced into the bowel and it is necessary to reintroduce the catheter for the second injection, which is a drawback. The other disadvantages of this method are, that it causes pain in a certain number of cases, and its effect is chiefly an eliminative, evacuant one; but even then it does not thoroughly cleanse the mucous membrane in the same way as the continuous irrigation systems, nor does it re-educate the bowel musculature.

Austin's irrigator and Stephen's anal tube are catheters with separate inlet and outlet tubes, and have the disadvantage that the two passage ways take up too much room for both to be of adequate size. The catheters with an inlet tube only are of simple construction, utilise the anal canal for the outflow, and consequently they can be made of small size and

are therefore easy to introduce into the bowel, and do not cause discomfort when in position. The Springfield Infirmary catheter is rather large and unwieldy; the Studa catheter is small and self-retaining; while the Borosini catheter has the advantage that the tip is made of rubber and is therefore very flexible, but it is necessary for the catheter to be supported by a rubber band to keep it in position.

The *Gymnacolon* (*Borosini*) apparatus has certain advantages over other appliances. The patient is in the lying position with the legs raised and supported so that the thighs are at right angles to the trunk, and the legs are flexed at the knees to a right angle. This position is a most convenient one for the application of abdominal massage; it also enables a weighted belt to be placed over the abdomen when there is any possibility of dilatation of the bowel. While the patient is lying in this position, there is no pressure whatsoever on the anus or neighbouring structures, so that the blood pressure is not raised by the treatment. The catheter is maintained in position without it being necessary to fasten any straps to the patient, and yet a wide range of movement is possible. The psychological effect on the patient of being able to see the waste matter which has been evacuated from the bowel is very great; incidentally it is possible to procure specimens of the fæces at any time during the course of the treatment. There is no risk of the patient catching a chill during the lavage. The level of the tank can be adjusted to the required height in a few seconds. The portable model of the apparatus, which does not require any special drainage facilities, is extremely useful when it is necessary to administer treatment in the patient's own home.

The *Studa* apparatus needs to be connected to the drainage system, and also needs a separate hot and cold water supply. It is, however, an excellent system, and the chair is so arranged that it is extremely easy to

introduce the catheter, which is of very simple construction, into the anal canal. The back of the chair is adjustable, so that the patient can lie on his back during

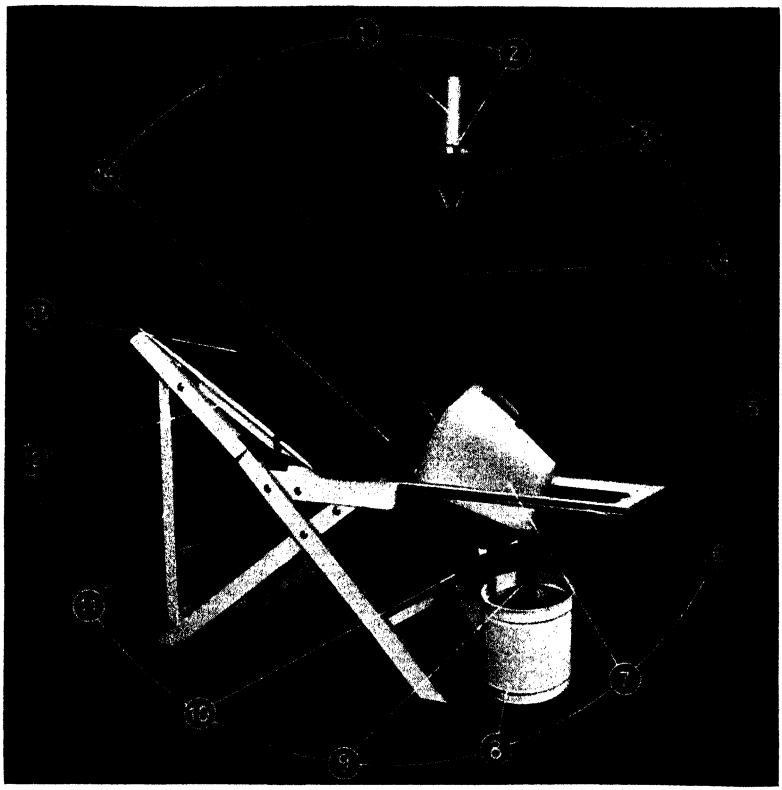

FIG. 21.—The Portable Gymnacolon Apparatus.

the treatment, but it is not quite so satisfactory in this respect as the Gymnacolon chair.

The *Subaqueous* apparatus is rather complicated and requires a bath and a special drainage system and water supply, the installation of which is costly. The technique of the administration of treatment is more complicated than is the case with the other systems, and therefore a

longer course of instruction is necessary. With this method, care must be taken to avoid the patient catching a chill after the treatment, and the patient's departure out-of-doors must be delayed in very cold weather.

There are some conditions in which colonic lavage with the Subaqueous intestinal bath is contra-indicated; these are chiefly certain skin diseases and cases with heart and circulatory weakness in which prolonged immersion in a hot bath may be undesirable.

The methods of irrigation which require the introduction of long rubber tubes into the colon are the Schellberg, the Honsaker, and the Vattenborg. The aim of the Schellberg system is to pass the catheter actually as far as the cæcum, principally for the purpose of introducing a culture of *B. acidophilus* into this part of the bowel. The catheter of the Vattenborg system, on the other hand, is only 30 in. long and cannot possibly reach the cæcum, therefore there is no object in having it more than 2 to 3 in. long, especially as it has been proved that fluid injected for a few inches into the rectum generally reaches the cæcum in about ten minutes. The disadvantages of the long catheter are, that it frequently coils round in the pelvic colon, and without going to the trouble and expense of having a Röntgen photograph taken, it is almost impossible to ascertain whether the tube is coiling. There is also no doubt that the patients much prefer the short catheter, because each forward movement of the long tube causes a certain amount of discomfort. In such conditions as diverticulitis, spastic constipation, and cases with Lane's kinks, the introduction of the tube is especially difficult.

It is quite correct that the skilled technician is able to pass the tube satisfactorily, but this is not the case with the beginner, and in the novice's hands the procedure may be dangerous and cause abrasion or even perforation of the bowel wall. The method is a very tedious one, and a great deal of valuable time may be

wasted in attempting to pass the tube the required distance. It is obviously a much simpler matter to introduce water into the cæcum than a tube.

The use of the Schellberg system is only justifiable, in the author's opinion, for the single purpose of introducing medicaments directly into the cæcum, and the method should not be used for the treatment of constipation and inflammatory conditions of the bowel. The Studa chair and Gymnacolon couch both function so satisfactorily that it is exceedingly difficult to choose between them. If it is frequently necessary to give treatment at a patient's own home, the Gymnacolon apparatus would probably be chosen, whereas if there is no need to move the appliance once it is installed, it might be decided, perhaps, to employ the Studa chair.

It is essential to make a careful examination of the patient before administering colonic lavage. Special attention should be paid to the condition of the circulatory system, especially the blood pressure. It is also advisable to examine the urine. Next, the anal region should be inspected and a digital examination made; in certain cases it may be necessary for the sigmoidoscope to be used.

A description of the methods of using the simple irrigation apparatus can be given without difficulty. The usual procedure is to arrange the patient in a reclining position on a couch covered with waterproof sheeting. The irrigating fluid, which can be either plain water or soap and water, is usually at a temperature of about 70° F. The fountain syringe is generally fitted with a metal reservoir, but a large funnel is sometimes used. This is attached by about 4 ft. of ½-in. rubber tubing to the nozzle which is inserted into the rectum, and 1½ to 2 pints of fluid are introduced slowly into the bowel. An attempt is made to retain this fluid for a variable length of time.

It is customary to give a second injection after the evacuation of the first. The reason for this is that the

irrigating fluid sometimes dissolves toxins which may then be absorbed from the bowel when a solitary injection is given, leading to the appearance of a skin eruption, known as an enema rash. The rash, which generally appears three to twenty-four hours after the enema, is usually morbilliform, and may occur on either the face, buttocks, and thighs, or on the chest and arms. The skin lesions soon disappear and never remain for more than twenty-four hours. The administration of a second injection effectively precludes the development of such a rash.

There have been very contradictory directions given in regard to—

1. The best position to be assumed by the patient.
2. The character of the irrigation fluid to be used.
3. The temperature of the fluid.
4. The total quantity to be used and also the maximum amount to be introduced into the bowel at one time.
5. The pressure at which it should be introduced.
6. The type of catheter and the distance it should be inserted.
7. The rate of introduction of the irrigating fluid.
8. The length of time the fluid should be retained.
9. The number of injections to be given at one attendance.
10. The most suitable time for the administration of treatment.

1. **Position.**—There is still great diversity of opinion as to what constitutes the most satisfactory position in which to place the patient.

De Graaf gives some interesting information on this point, which it may be helpful to quote even to-day.

"As to the side on which the patients should lie to receive the lavages, some stipulate that the patient should be on the right side, others on the left; those who prefer the right side, say that the lavage traverses

the canal of the large intestines more easily, because, in this way, the largest area of the colon, which is situated on the left, is not compressed by the weight of the other parts of the intestine, as is the case when the patient lies on the left side. Those who place their patients on the left side, say that the compression of the large intestines is not considerable enough to prevent the clyster passing, and that the rectum is in the shape of an S which curves towards the left side; the clyster slides better into the large intestine lying under the stomach, which they consider impossible when the patient is lying on the right side, all the more since, by the situation of the intestines, the lavage has to go up the left side in order to flow into the rest of the colon. To end this controversy, according to the knowledge which I have of the human body, gained by a very great number of dissections of human corpses, I think that it matters very little which side one lies on; and if there were any choice, it would be to have the patient lying on his back, for then the large intestine situated on the left side is not compressed, nor is the clyster obliged to rise, as when one is on one side or the other. In order that the clyster may traverse all the parts of the colon more easily, I would advise the patients to place themselves sometimes on one side, sometimes on the other, and finally, to stay on the side where they feel more pain."

Kellogg has also said that the position chosen is not a matter of great importance, and that treatment can even be given in the erect position. It may, however, be of interest to mention the different positions which have been advocated. The author can find only one advocate of the standing position, and the same applies to the sitting position. The knee-elbow position has, however, been recommended by several writers, but the various recumbent positions seem to be the most frequently employed. One writer suggests that treatment should be given with the patient lying face downwards.

Other positions which are frequently adopted are as follows :—

The patient lies—

(*a*) On the back with the hips raised by pillows.
(*b*) On the right side in the semi-prone position.
(*c*) On the left side in the semi-prone position.

Other writers make the suggestion that the position of the patient should be changed during the course of the treatment.

(*d*) First on the back with the hips raised, then turning on to the right side in the semi-prone position, turning on to the back again when there is a desire to defæcate.
(*e*) Two minutes on the right side, then turning on to the back for two minutes, and finally on to the left side for the same time.
(*f*) First on the left side, then into the knee-elbow position, and finally on to the right side.

It is interesting to note, however, that Hurst has found, while using the Röntgen rays, that in rare cases the barium enema does not pass the splenic flexure unless the patient lies on his right side in the semi-prone position.

The remarks of a blind masseur patient of the author's are of interest; he had colonic irrigation by two different methods. "Lying down flat on one's back seems to obviate to a considerable extent the collection of gas in the intestines, which appears to block the passage of the liquid and produce such nasty cramps. The protrusion of my rectal prolapse was decidedly less marked, too, when one was lying flat."

2. **The Character of the Irrigating Fluid to be Used.**—The different irrigating fluids that are most commonly employed will be considered in Chapter VII.

3. **Temperature.**—De Graaf makes some interesting remarks on the subject of the temperature of the irrigat-

ing solution; he says: "The lavages should not be given too hot or too cold, but mediumly hot. They are given a little hotter when the intestines are infected with too much mucus and are filled with wind. But they must not be so hot that it is impossible to retain them. In hot fevers and other diseases which require cold, they should be given a little cold. Pregnant women must not have them too hot, as their intestines are extremely sensitive, and eject the lavages without their having been of any use."

There is no doubt that certain conditions are most satisfactorily treated by using solutions at a relatively low temperature, and in other cases considerably higher temperatures are required. This accounts for the great variation which occurs in the temperatures advised by different writers.

Reboul, of Châtel-Guyon, suggests that the irrigating fluid in certain cases should be very hot or cold when a stimulating effect is desired, and about body temperature (95° to 98° F.) when a soothing action is necessary. When pain is not present, he advises temperatures of 65° F., or even less, 45° to 50° F.

Other suggestions are:—

95° to 100° F.
95° to 118° F.
98° F.
98° to 122° F.
100° F.
100° to 104° F.
102° F.
102° to 105° F.
104° to 113° F.
111° to 113° F.

The lowest temperature is therefore 45° F., and the highest 122° F.—a range of 77° F.

The most satisfactory routine temperature for the irrigating solution is probably 104° F., hotter solutions

being used in cases of spastic constipation and colic, and colder in atonic constipation, hæmorrhoids, etc.

4. **The Quantity of Fluid.**—There is almost as great a diversity of opinion in regard to the most suitable quantity of fluid to be used. De Graaf says the amount should vary according to the age: "3 oz. are enough for a small child, 4 for a larger, 5 or 6 for an older one, in proportion. About 13 oz. are ordered for an adult; but there is need for circumspection. For example, pregnant women, when the fœtus is large, cannot receive large lavages. In the second place, in calculus or inflammation of the kidneys, the lavages should be small, because intestines which are too full augment the pain by pressure. Thirdly, when the intestines are swollen by wind, large lavages should not be given, nor should violence be used, because by being pushed roughly into narrow places, they will distend the intestines even more and will cause terrible pains."

The following figures are the suggestions of different modern authors:—

0·5 pint,
0·8 pint,
0·88 to 1·76 pints,
1 to 2 pints,
1 to 3 pints,
1·3 to 1·5 pints for the first injection, and 1·5 to 1·8 pints for the second,
1·76 to 3·5 pints,
2 pints,
2 to 3 pints,
3 pints,
3 to 4 pints,
3 to 5 pints,
5 to 10 pints,

which are the amounts which were said to have been used originally at Plombières; but it is obvious that the

two larger quantities could not possibly have been used in a normal case, though it is of interest that Fox has stated that patients with exceptionally large or dilated colons have been known to retain 6 to 9 pints.

The author had a patient who had been, for a considerable time, in the habit of injecting 10 pints of fluid into his bowel. A Röntgen photograph, taken after a barium enema, showed considerable dilatation of the large bowel.

In a pamphlet published by Dr A. Wilford Hall in 1880, he claims that he gave himself a series of colonic injections, using increasing quantities of fluid. On the first occasion he injected a pint of water by means of a bulb syringe. Next, he used a quart of warm water. Two days later he states that he tried again, using 2 quarts of water, warm enough to be comfortable to the hand, and, to increase its lubricating and cleansing process, a little soap was added. On this occasion he made an effort to retain the water for a few minutes, which required a strong effort of the will. Two evenings later the fourth injection was made, and this time he injected 3 quarts of water. He felt ravenously hungry about half an hour after this injection. Three evenings later, he says, he slowly and carefully injected 1 gal. of water, which he retained for several minutes and then discharged. There is no doubt at all that the average person would find it quite impossible to tolerate the injection of such a large quantity of fluid.

The effective range is, however, between 0·5 and 3 pints, the most usual quantity being 1 to 2 pints. In the newer methods of colonic irrigation, which are described at the end of this chapter, very large total quantities of fluid are used, viz., 4 to 8 gals., or even more, but the amount of fluid in the large bowel rarely exceeds, at any time, ½ pint.

5. **Pressure.**—When an enema syringe is used to inject the irrigating fluid, it is extremely difficult to determine the exact pressure which is being employed;

the same difficulty occurs with the type of apparatus in which the weight of the patient's body on the india-rubber reservoir bag supplies the necessary pressure.

When the force of gravity is employed to introduce the fluid into the bowel, the height of the container above the point of injection supplies the necessary information.

A distinction must be made between those methods in which the irrigating fluid is retained for an appreciable time, and the newer methods whereby the patient is free to evacuate the bowels whenever desired, and in which no effort is made to retain the fluid. In certain cases, however, with these latter methods 5·3 oz. of a concentrated solution are injected at the end of a lavage, during which a weak irrigating solution has been used, and allowed to remain in the bowel.

The following pressures have been advocated :—

4 in.
10 to 12 in.
10 to 14 in.
10 to 24 in.
12 in.
12 to 16 in.
12 to 18 in.
18 in.
24 in.
24 to 36 in.
Not higher than 36 in.
36 to 72 in. } Borosini and Subaqueous intestinal
60 to 72 in. } methods for immediate evacuation.

6. **The Nature of the Catheter and the Distance it should be Inserted.**—The various types of catheter have been described in Chapter V.

There is considerable divergency of opinion in regard to the distance which the catheter should be introduced. It has been suggested that owing to the pelvi-rectal flexure, which is situated at the junction of the fixed

rectum, with the freely movable pelvic colon 4½ in. from the anus, it is very rarely possible to pass a flexible tube beyond the flexure. The work of Schellberg —who uses a rubber tube 54 in. long—proves that this is not the case. Except when it is desired to pass the tube as far as the cæcum, there seems little point in introducing the catheter more than a few inches into the bowel.

The following table gives the distance which different operators introduce the catheter into the bowel :—

2 in. beyond the anus.
2 to 3 in.
3 to 4 in.
4 in.
3 to 6 in. for low enema.
4 to 5 in.
5 in.
6 in.
6 to 12 in. for high enema.
8 in.
A few inches at first, then as far as it will possibly go, *i.e.*, 10 to 12 in.

Mantle found that patients treated at Harrogate suffered much less exhaustion after the treatment, when the irrigating tube was introduced just inside the rectum, than previously, when it had been inserted for 10 in. The irrigating fluid also entered the bowel with greater ease.

Machell has found that patients having irrigation prefer the short tube to the long one.

7. **Rate of Introduction.**—The data given do not refer to the latest methods of colonic irrigation.

1 pint in 15 to 20 minutes.
1 pint in 7 to 8 minutes.
1 pint in 5 minutes.

8. **The Length of Time the Fluid should be Retained.** —De Graaf gives interesting information on this point :

he states "That the time which it is necessary for clysters to be retained is different according to their composition. Emollients and *detersives* should not be retained for more than half an hour; anodynes should be retained for a longer period, and the consolidating glutinous clysters even longer. Purgatives usually come out of their own accord."

First Injection.

1 to 2 minutes.
3 to 6 or even 10 minutes.
5 minutes.
5 to 10 minutes.
10 minutes.
10 to 15 minutes.
15 minutes.
As long as possible.

Second Injection.

5 minutes (10 to 15 minutes for first).
5 to 10 minutes (5 minutes for first).
9 to 10 minutes (1 to 2 minutes for first).

If the introduction of the fluid into the bowel does not induce the desire to evacuate, fifteen minutes should be allowed to elapse before an attempt to defæcate is made.

Machell investigated the time of retention of the irrigating fluid, using both the long and short colon tubes. With the long tube, 31 patients returned the fluid at once, 22 retained it up to two minutes, and 15 from two to four minutes. With the short tube, 31 persons returned the fluid at once, 28 retained it up to two minutes, and 18 from two to four minutes. Less fluid was retained when the short nozzle was used.

9. **The Number of Injections to be given at One Time.**—There is general agreement that more than one injection is desirable, the usual number being two. With the latest methods of continuous irrigation,

however, thirty to sixty consecutive injections are customary.

10. **The Most Suitable Time for the Administration of Treatment.**—De Graaf says that "although lavages can be given at any hour, it is as well, except in case of necessity, to give them two or three hours before a meal, in order not to trouble the digestion of the stomach."

At a spa it is probably most convenient for the treatment to be given in the morning before breakfast, or some hours after an early evening meal. The morning treatment makes it possible for the lavage to be administered at the usual time of going to stool, which is a matter of considerable importance. Otherwise the treatment can be given throughout the day, with the exception that it is undesirable to undertake the treatment after a rather substantial breakfast or lunch, that is, within two and a half hours of its completion, as nausea and vomiting might result.

It has already been mentioned that there are certain variable factors which must be decided before colonic lavage is administered. To recapitulate, these are—

1. The most convenient position for the patient to assume during the treatment.
2. The type of apparatus to be used, and the variety of catheter, also its length and diameter.
3. The lubricant to be used on the catheter.
4. The nature of the irrigating fluid.
5. The temperature of the irrigating fluid.
6. The quantity of irrigating fluid.
7. The pressure at which the fluid is administered, and also its rate of flow.
8. The time to be allowed for the irrigation.
9. The time the injection has to be retained.
10. The probable number of applications necessary.

Necessarily, these factors vary considerably in the different methods of colonic lavage, and it will therefore

probably be wisest to consider each method of irrigation separately.

The Plombières Douche Horizontale.—De Langenhagen wrote a number of papers on his method of colonic irrigation. One of these appeared in the *Lancet*, i. 1186-1233, 1904, and another was published as a brochure in 1925. There are certain differences noticeable in these two papers; the details of the technique vary considerably, especially in regard to the quantity of fluid which should be injected, and also its pressure.

The operator introduces a sufficient quantity of thermal water from the Source des Dames at the right temperature into the container, and demonstrates to the patient the level gauge on the container and the quantity of fluid which the doctor has prescribed for each injection. Originally 2·6 to 3·5 pints were prescribed for each injection, but in 1904 De Langenhagen had decreased this amount to 2 to 3 pints, and in 1925 to 0·88 to 1·76 pints. The temperature of the irrigating solution naturally is modified in different cases, but temperatures varying between 95° and 118° F. were first advised, and later, in 1925, temperatures of 111° to 113° F. The operator next adjusts the height of the container above the couch. The distances originally suggested were 60 to 70 in.; in 1925 the height advised was 10 to 14 in. (25 to 35 cm.). Finally, the operator regulates the lever on the wall pipe which controls the rate of flow of the irrigating fluid.

De Langenhagen at first advised that the irrigating fluid should be introduced slowly at a rate of 1 pint in five minutes; later, in 1925, he suggested 0·88 pint, or 500 c.c. in six to seven minutes, which is the equivalent of 1 pint in seven to eight minutes. He called it "drop by drop injection."

In certain cases it was advised that a decoction of bran, linseed, or marshmallow root (*Althea officinalis*) should be added to the thermal water. The patient, suitably dressed, lies on the treatment couch slightly

turned on to his right side, with his legs partially flexed and drawn up. The operator next lubricates the catheter with some soft paraffin, or other suitable lubricant, and gently introduces it into the anal canal and slowly pushes it as far as it will go. The tap is then opened and the fluid allowed to enter the bowel. The patient can see the level gauge during the treatment, and as soon as the prescribed amount has been introduced, he closes the tap and withdraws the catheter.

During the injection of the fluid the patient turns over further towards the right, until, finally, he is lying almost in the prone position; then he gets up from the couch and sits on the separate water-closet and empties the bowels. This first injection is known as the evacuating injection, and its function is to remove the fæcal contents of the bowel.

The patient then returns to the couch and another injection is carried out under exactly the same conditions, except that an endeavour is made in this case to retain the fluid for three to six or even ten minutes. Afterwards the patient either rests for some time on a couch, with a hot-water bottle or electric heating pad over his abdomen, or else has a thermal bath with an underwater-douche applied to the abdomen.

The author recently visited Plombières, and was given the following prescription by one of the spa physicians :—

Horizontal douche; height, 30 cm.; temperature, 42° C. (107·6° F.); to be given at constant pressure with cannula No. 3. Douche to be taken with patient turned slightly on to the right side; 700 grm. (1·2 pints) to be introduced at first, and the bowels to be evacuated immediately.

For the second injection 600 grm. (1 pint) to be introduced and retained for a few minutes if possible.

Severe colicky pain was experienced before the prescribed amount was injected, and the inflow had to be stopped.

The time actually required for the introduction of 600 grm. (1 pint) of fluid was noted on different occasions, and was found to vary between eight and nine minutes.

De Langenhagen advised that, as a general rule, two to three treatments should be given each week, and that the most satisfactory time for administration was before breakfast or two to three hours after the evening meal, just before going to bed. He considered that the treatment is a form of internal bath which cleanses the mucous membrane, removes all mucous secretions and food debris, reduces congestion, and regulates the contractibility of the muscular coats of the bowel, relieving spasm.

In the year 1905, the Plombières colonic treatment was introduced at Harrogate, with certain modifications, by Dr J. Liddell. Two waters are used for the irrigations: saline sulphur with 7 grm. of solid matter per litre, and sulphur water containing only 0·62 grm. per litre, the stronger water being used when a stimulating action is desired, and the weaker water when a sedative effect is required; 1·3 to 1·5 pints are generally used for the first injection and 1·5 to 1·8 pints for the second, at a pressure of 18 in. and a temperature of 102° F. The patient lies first on the right side for two minutes, then on the back for two minutes, and finally on the left side for the same time.

At Harrogate the catheter is only introduced for 4 in.; 127,475 treatments were given there in ten years (from March 1915 to March 1925).

At Buxton a radio-active water containing total solids 0·32 grm. per litre is used.

At Châtel-Guyon a water with 8 to 9 grm. of solid matter per litre was originally used, and naturally it reacted in a different way from the Plombières water, which has only 0·2 grm. per litre.

The Austin Irrigator.—It is extremely simple to use, and the rectal catheter can be employed with any

irrigating apparatus. The apparatus is, however, provided with an india-rubber reservoir, which is filled with the necessary solution at the required temperature. The bag is suspended at least 2 ft. above the level of the catheter. The free end of the rubber tube from the reservoir is attached to the lateral inlet-tube opening and the catheter, lubricated with soft paraffin, is gently inserted into the rectum with the small spray holes in the catheter directed forwards. Before insertion the catheter is filled with the irrigating fluid, and the rubber tubing clamped. The patient can now sit down on a water-closet or commode. After the insertion the clamp is released and the irrigating fluid is allowed to run slowly into the rectum. When there is a desire to evacuate, the voluntary muscles of defæcation are contracted, and the fluid in the bowel passes out through the large central aperture of the catheter. This process of irrigation is generally continued until 10 pints have been used. A temperature of 110° F. is advised. Later, a further 3 pints of fluid at 80° F. can be used to terminate the treatment. If there is any pain, it is a simple matter to withdraw the catheter and replace it later. Finally, at the termination of the irrigation, the catheter should be removed, and the patient instructed to remain seated on the closet, to allow any fluid which may have been retained to be evacuated.

The largest of the three irrigators which can be inserted without discomfort should be used; as already mentioned, their sizes are $\frac{3}{8}$, $\frac{1}{2}$, and $\frac{5}{8}$ in.

Stephen's Anal Tube.—The patient lies on his left side in the Sims position on a surgical couch, with mackintosh material placed under the buttocks. The obturator is now placed in the inlet tube of the catheter, and the instrument is carefully lubricated. The catheter is now slowly introduced into the anal canal, the patient meantime being asked to bear down slightly when the catheter is in the rectum. The obturator is withdrawn, and the waste pipe attached to the large effluent tube. The

waste pipe is arranged to empty into a slop pail. The metal inflow tube, which is connected with the reservoir by rubber tubing, is now inserted into the inlet tube of the catheter—this opens the valve of the catheter. Irrigation can now be commenced without there being any fear of the catheter being displaced. Water is run into the rectum from the reservoir, and the colon emptied by releasing the clamp on the waste pipe. This process is repeated until the colon is emptied.

The Springfield Infirmary Apparatus (Portable Model).—The catheter of this apparatus is designed so that it can be introduced into the anal canal by the patient himself. The tip is lubricated and then, by the sense of touch only, the catheter is inserted, and is held in position by the contraction of the sphincter muscle. The patient then gently sits down on an ordinary water-closet seat and introduces fluid into the bowel by means of the Higginson syringe. The patient is able to defæcate when the desire is experienced without dislodging the catheter. The process is repeated until the large bowel is thoroughly cleansed. The hospital model of the apparatus is identical, except that the Higginson syringe is replaced by a 3-gal. gravity feed tank.

The Vattenborg Apparatus.—The patient lies on a waterproof sheet on the treatment couch on his left side, in the Sims position, with his back turned to the operator. The left leg is flexed at an angle of about 45°, and the right leg flexed as far as comfortably possible. The buttocks are arranged on the edge of the couch. The operator can then separate the buttocks with the left hand and hold the applicator with the right. The applicator, which has the obturator in position, is warmed and carefully lubricated, and is then firmly pressed against the sphincter muscles and inserted into the rectum in exactly the same way as a proctoscope. When the applicator is in position in the rectum, the obturator is removed, and the colon tube, which has been carefully lubricated and pushed through the hole

in the screw cap of the applicator for a distance of $2\frac{1}{2}$ in., is then introduced into the inlet opening of the applicator. Air is then expelled from all the tubing of the apparatus, first by opening the large percolator valve and pressing the deflation bulb which drives air into the reservoir, next by opening in turn the three valves on the valve-block control. Fluid is allowed to flow from the percolator through the colon tube and then into the applicator return chamber and out into the waste receptacle. The valves from the percolator are now left open and the irrigating fluid allowed to flow into the rectum; the colon tube is then slowly inserted for about another 5 in. The inlet valve is next shut and the two outlet valves opened, so that the fluid which has been introduced into the bowel flows out through the two outlet valves into the waste receptacle. Later, the process is repeated and the colon tube introduced for another 2 in. Generally, 1 pint of fluid can be introduced into the bowel without causing pain.

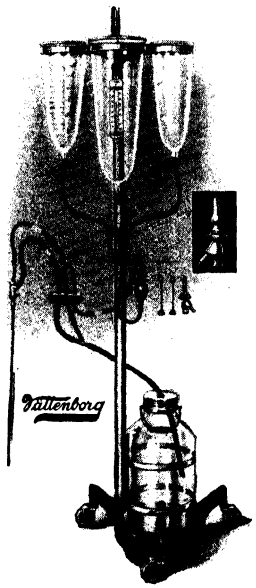

FIG. 22.—The Vattenborg Apparatus.

Hand massage to the abdomen is frequently given during the irrigation. The lavage can be continued until all the fluid in the large percolator has been introduced into the bowel and evacuated. The medicament from one of the small percolators can then be introduced into the colon; a pint is generally used. The patient should be instructed to endeavour to retain this fluid in the bowel for two to five minutes, and turn on his right side, assuming the dorsal position when the fluid is being gently expelled. If desired, the treatment

can be concluded by the withdrawal of the colon tube until only 2 in. project through the applicator, and then an injection of 1 pint of cold water at a temperature of 60° to 70° F. can be made. This has a tonic effect on the rectum and checks the desire for immediate defæcation.

The patient remains on the couch for several minutes after the applicator has been removed and the anal region cleansed. Sometimes, when the patient gets down from the table and stands upright, there is a desire again to empty the bowels. This is best done at the closet.

The Honsaker Apparatus.—It is hardly necessary to make much reference to this process of colonic lavage, as the method is very similar to both the Vattenborg and Schellberg systems.

The special mixing chamber, which is at an accessible height, renders it unnecessary for the operator to climb up to introduce medicaments directly into the percolator. The thermometer which is connected with the mixer is very legible, as it is placed at the same level as the operator's eyes.

The apparatus can be made to withdraw gas by suction from the bowel, and this feature also makes it unnecessary to displace air from the irrigating tube before introducing it into the bowel. As it is possible to fill the percolator rapidly, there is no need to provide any means of keeping the solutions in the percolator warm.

The Schellberg Apparatus.—The patient should have his bowels opened before the irrigation; he then lies on his left side on the special Schellberg couch in the Sims position. All air bubbles are removed from the various tubes, and the colon tube is filled with irrigating solution and clamped about 8 in. from its tip. The tube is now lubricated and gently introduced into the anal canal and the clamp removed. Irrigating fluid is now allowed to run slowly into the rectum from the

large percolator by placing the handle of the valve control in the vertical position. When 3 to 4 oz. have been introduced, the three-way valve is reversed by pulling the handle into the horizontal position and the fluid allowed to escape into the metal waste bowl. While the fluid from the percolator is flowing, the colonic tube is gently introduced further into the bowel; whenever the returning water is clear, the tube should be advanced a few inches.

Occasionally, though the irrigating fluid has produced moderate distension of the bowel, it may not be possible, for the moment, to pass the colon tube further into the intestine. Sometimes it is possible to do this by opening the outlet or release valve, which allows the fluid to escape, and at the same time pushing the tube forwards. Occasionally it is necessary to distend slightly the bowel with fluid and then withdraw the catheter for a few inches with the release valve open, allowing gas and fæces to escape. More fluid is immediately run into the bowel and the catheter passed forwards. Careful attention should be paid to the glass pressure valve.

This procedure of introducing the fluid into the bowel and then allowing it to escape is continued until the tube is introduced as far as the cæcum. The colon tube should never be passed into the cæcum, however, until the rest of the colon is empty. It is not generally possible to do this during the first two or three applications. The tube should never be introduced too quickly, or fæcal matter may be pushed inwards, causing impaction. When the cæcum has been evacuated and the return fluid is colourless, a culture of *B. acidophilus* may be allowed to flow into the cæcum from one of the small percolators. The colon tube is then slowly withdrawn and the culture spread along the whole of the bowel as far as the pelvic colon, which is then distended with sterile water. When the patient experiences a strong desire to evacuate, the tube is

completely removed and the patient allowed to sit up on the couch and defæcate into the fæcal container.

Daily irrigations are recommended with the Schellberg apparatus, and one to two hours may be required. M'Donagh, however, advises that the first two treatments should be given on successive days, and then once or twice a week.

The satisfactory passage of the long colon tube naturally requires considerable practice and experience, and it is generally some little time before the operator learns to distinguish the different conditions which prevent the forward passage of the tube. If discomfort is felt by the patient it means that the irrigation is being administered in an unsatisfactory manner.

The bullet-shaped end of the tube is fairly flexible, and will, therefore, usually bend round rather sharp angles, but the body of the tube is more rigid. The flexibility depends in a large measure on the length of time the tube has been in use, as frequent boiling for the purpose of sterilisation naturally makes the tube softer.

The cleansing solution from the large percolator is used to remove gas and fæces, and also to produce gentle dilatation of the bowel when this is required.

At the first treatment it may be only possible to pass the tube as far as the splenic or even the sigmoid flexure. When the tube reaches the splenic flexure, it is, however, generally possible to siphon off the contents of the transverse colon.

In certain cases, a solution of colloidal silver 1 in 8,000 at a temperature of 50° C. (122° F.) is run in through the colon tube, which is then removed and the patient immediately raised to the sitting position, with the instruction to relax the muscles gently.

Sometimes difficulty is experienced in passing the tube through the splenic flexure; when this occurs it is necessary to withdraw the tube for a few inches and dilate the flexure with the irrigating fluid; as the patient

is lying on his left side, this fluid can be readily siphoned off.

Occasionally trouble is experienced in passing the tube along an unduly pendulous transverse colon, but with perseverance and by alternately withdrawing and pushing forwards the tube while the patient is lying on his back, it is nearly always possible to overcome this difficulty.

It should also be remembered that the passage of the tube often mechanically lifts up the bowel, and the forward flow of the water tends to have the same effect.

It may be necessary to withdraw slowly the tube with the release valve open, in cases where there is a considerable quantity of gas present in an atonic bowel, and where there is no residual fluid, owing to the tip of the catheter resting against the upper wall of the bowel. If the tube is withdrawn, this gas is usually able to escape. The colon tube is then reinserted and the treatment proceeded with.

It is particularly in spastic cases that difficulty may be experienced in passing the tube through the pelvic colon. In these cases it is generally advisable, once the tube has reached this part of the bowel, to inject a solution of colloidal silver and make no other attempt that day to pass the tube further. It must always be remembered that the cæcum and ascending colon possess marked powers of absorption, and that medicaments introduced into them speedily reach the blood stream.

The Borosini Treatment.—It is advisable for patients to undress partially, removing the trousers and drawers, or in the case of a woman patient, the knickers and combinations, if these should happen to be worn. All patients should, if possible, urinate before commencing treatment. A sheet of crêpe paper is laid over the cushion covering the couch back, and a small piece of rubber sheeting is placed round the rubber pad which rests on the upper rim of the fæcal funnel. The fæcal funnel is pulled outwards as far as possible along the

supporting rods, and then the patient climbs on to the couch. The rectal catheter, which has been lubricated with soft paraffin, is carefully introduced into the anal canal, and the rubber band from the catheter is attached to the clamps provided for the purpose on the couch, and adjusted so that the catheter is in the correct position. If the case should happen to be one of spastic constipation, a rubber rectal tube, 2 in. long, is used instead of the normal tube of 1 to $1\frac{1}{2}$ in.

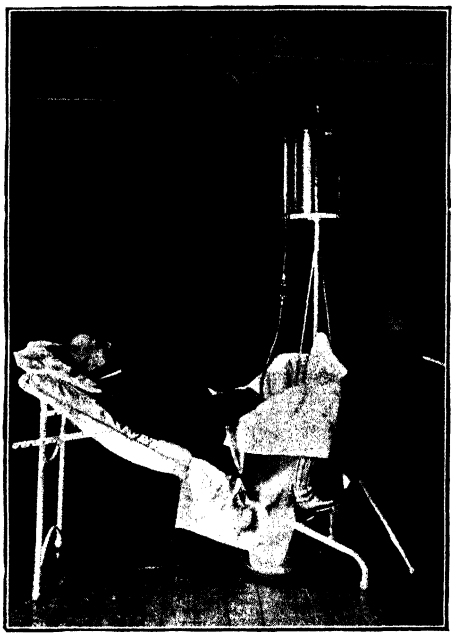

FIG. 23.—Patient having Treatment with the Old Model of the Borosini Apparatus.

The combined leg and foot rest is then adjusted by unclamping it and moving it along the supporting steel rods, and also by arranging the angle at which it is inclined.

The fæcal funnel is now placed firmly against the patient's perinæum. The reservoir is then raised to the top of its stand by means of the safety windlass, and all the air is expelled from the rubber tubing by means of the compressible india-rubber valve. The tubing from the reservoir is next attached to the vertical inlet tube of the catheter, and the tap handle turned to the vertical position. The irrigating fluid now passes through the catheter into the rectum. It is customary to place an electric heating pad over the patient's abdomen and a weighted band on top of this. The

patient can then be covered with a blanket, the electric inspection lamp lighted, and the adjustable mirror arranged so that the patient is able to see the contents of the fæcal funnel. The patient should be told to bear downwards and empty the bowels the moment there is any desire to do so; the undesirability of attempting to retain excessive quantities of the irrigating fluid in the bowel should be pointed out. The outcoming fluid and fæcal matter do not dislodge the rectal tube, but on the contrary flow freely past it. The pressure control valve automatically stops the inflow of irrigating fluid when defæcation is taking place. Sometimes it can be seen from the glass control valve that the irrigating fluid is not flowing into the bowel. When this occurs, a slight readjustment of the rectal catheter will nearly always rectify the fault, which is generally due to the india-rubber rectal tube becoming bent in such a way that the lumen is obliterated.

On those rare occasions when a considerable quantity of fluid has run into the bowel and evacuation is delayed, the tap handle of the rectal catheter should be placed in the horizontal position and the fluid allowed to flow out through the outlet opening. The intra-colonic pressure at once falls, and any cramp or griping which may have occurred is relieved.

Patients occasionally experience difficulty, during the first application of the treatment, in emptying the bowels in the recumbent position, and it may be necessary to get them to sit upright for a short time. Patients learn, however, in a very short time to overcome this difficulty. Some irrigation fluid gradually collects in the bowel and finally reaches the cæcum. A proportion of this fluid is absorbed by the large bowel and excreted by the kidneys. Every half pint or so of fluid which enters the colonic canal induces an evacuation of the bowels, so that there are generally evacuations about every thirty seconds.

At the first application only 2 gals. of fluid may be

used, but subsequently this can be increased to 6 or 8 gals. At the end of the irrigation the outlet tap from the reservoir is closed and the rubber band which is attached to the catheter is loosened, and the next time defæcation occurs the catheter generally falls into the fæcal funnel. The patient then remains lying on the couch for another five or ten minutes and evacuates any fluid which may have been retained.

Treatment generally lasts for forty-five to sixty minutes, the actual irrigation being continued for thirty to forty-five minutes. At first it is customary to give treatment every other day, but later it may be given twice or even once a week. In exceptional cases, such as in food poisoning, treatment should be given daily.

Treatment, as has already been mentioned, should never be given directly after a heavy meal. It is advantageous to apply the treatment at the same hour each day. The bowels are not generally moved the day following the first five or six irrigations, but after that, in a number of cases, defæcation takes place the next day. When that occurs, it may be desirable to give the remaining treatments at longer intervals.

Purgatives should never be given during the course of lavage treatment, though it is permissible to administer some liquid paraffin preparation on the alternate days between the treatments.

The Borosini apparatus can either be placed over a fæcal bucket or else connected with the soil pipe.

An extremely useful feature of the apparatus is the device for collecting the fæces at any time during the application of the treatment. It consists of a concave sieve, which is fitted with a long handle; this can be withdrawn from the base of the fæcal funnel at any time without soiling the hands.

The Studa Chair.—The tank is generally filled with a slightly hypotonic solution of sodium chloride at a temperature of 104° F. The outlet tap of the tank is opened, and fluid allowed to flow through the irrigation

tube. The rubber tube below the pressure-control chamber is compressed once or twice, so that air is expelled from the tubing. Then the medicament funnel tap of the chamber is opened and the irrigation tube again compressed, and when the pressure-control chamber is filled with fluid, the tap is closed. The height of the fluid in the pressure-control chamber is now adjusted by closing the tank outlet tap and opening the medicament funnel tap until the surface of the fluid in the pressure-control chamber is just below the level of the openings of the inlet valve. When it is desired to introduce any medicament during the course of the treatment, it is poured into the funnel, the irrigating tube tap closed, the funnel tap opened, and the medicament is drawn into the pressure-control chamber. The fluid level is then adjusted, the funnel tap closed, and the irrigating tap opened. Fluid left stationary in the irrigating tube rapidly becomes cold, so that some fluid should be allowed to flow through the tubing immediately before the commencement of the treatment.

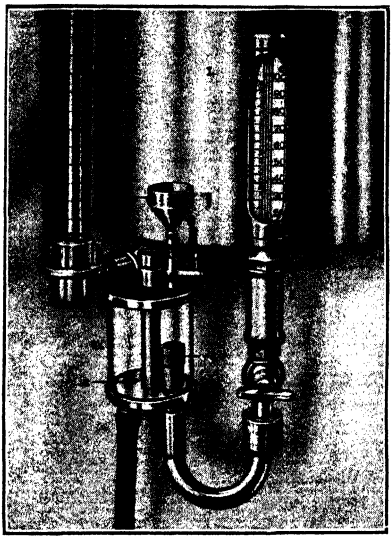

FIG. 24.—The Check Valve, Thermometer, and Water-level Gauge of the Irrigation Tank of the Suba and Studa Chair Apparatus.

The patient mounts the chair and stands on the upper step with the back to the seat, and bends the body forwards on the hips. The catheter, which has been lubricated with soft paraffin (a tube of vaseline is very convenient for this purpose), is now carefully introduced into the anal canal, and is kept in position

when the patient sits down on the ring cushion by the pressure of the perinæum on the horizontal limb of the catheter. The catheter is not dislodged when defæcation takes place, but remains in the rectum throughout the treatment.

When the treatment is commenced, the irrigating solution is allowed to run slowly into the rectum, and evacuation occurs when the intra-colonic pressure

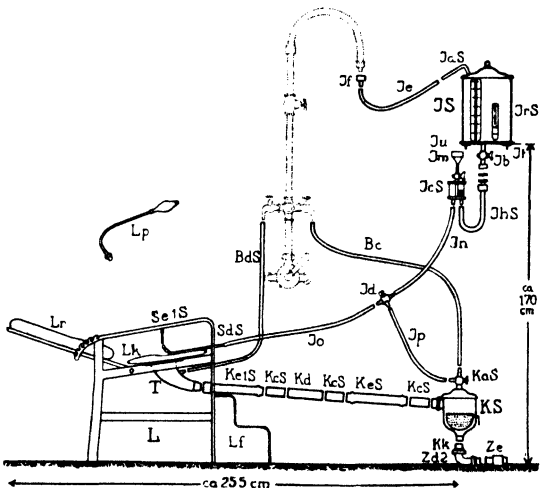

FIG. 25.—Diagram of the Studa Chair.

has become sufficiently great—generally when half a pint of fluid has entered the bowel. The patient, finding he can defæcate whenever he wishes without moving or altering his position in any way, soon feels at ease, and evacuations take place at regular intervals.

Fifty or sixty rhythmical evacuations generally occur if the treatment is continued for half an hour. At first the irrigating fluid empties the rectum and sigmoid flexure, but after ten minutes have elapsed, it flows into the transverse colon and gradually evacuates its contents ; finally, it finds its way down the ascending colon into the cæcum. X-ray photographs of barium

enemas have, however, shown that a small part of the injection rapidly reaches the cæcum.

At this stage of the treatment the urge to evacuate can be disregarded for a short time to allow a slightly larger quantity of fluid to collect in the bowel. No irrigating fluid normally passes through the ileo-cæcal valve.

In many cases when the bowels have been moved on the same day as the treatment, clear fluid is evacuated for the first ten minutes ; but later, when the irrigating fluid commences to empty the transverse colon, the effluent becomes highly coloured.

The treatment gently removes all residual matter from the lumen of the large bowel, but an even more important factor is the effect on the bowel musculature. The muscles are rhythmically exercised in the course of an average treatment as often as they would be normally in four to eight weeks ; that is, the irrigation produces thirty to sixty evacuations, the mechanism of defæcation being called into action each time.

It must be remembered also that the bowel musculature not only ensures the passage of food through the intestinal canal but also exercises a definite protective function in regard to the sensitive intestinal mucosa, and prevents the intestinal contents from causing undue irritation to the numerous intestinal glands and nerve endings.

The frequent muscular contractions stimulate the circulation of the whole abdomen and counteract stasis and engorgement of the splanchnic system. Food metabolism and adsorption are also aided.

Patients very rapidly become accustomed to the treatment, and it is rare for them to suffer any discomfort. If any cramp-like pains should occur, the irrigating fluid is immediately stopped and a release valve opened, which allows any fluid which may have accumulated in the bowel to escape freely. When pain occurs it is nearly always caused by excessive intra-

abdominal tension, and the moment the tension is released, the pain disappears. Patients should always be warned before treatment to complain if they feel any discomfort. They should also be advised that diuresis is increased by the treatment, fluid being freely absorbed by the colon and excreted by the kidneys. There is nearly always increased appetite after the treatment, due to reflex stimulation of the gastric, hepatic, and pancreatic nerves. Often there is an increased discharge of flatus, especially after the second or third treatment; this is a sign of improved colonic tone.

The first application is generally of fifteen to twenty minutes' duration, but if fatigue is experienced it can be made shorter. As already mentioned, treatment can be given in the morning after a very light breakfast, or late in the afternoon after an early and light lunch. It should never, for obvious reasons, be given immediately after a heavy meal.

When the flow of irrigating fluid has been stopped, the rectal catheter should be removed and the patient requested to remain seated on the chair for another ten minutes or more, as during this time considerable quantities of effluent may be passed. For the same reason, the patient should remain in the house for a short time after the treatment. At the commencement of the course of treatment there is usually no movement of the bowels on the day following treatment, but after the fifth or sixth application, in favourable cases, there is a daily evacuation. The prognosis becomes especially good when this occurs. The improvement in the force of evacuation, which becomes marked in the later treatments, is another satisfactory feature.

The Subaqueous Intestinal Bath.—This apparatus is used in a bath, which is fitted with a properly trapped waste pipe connected with the soil pipe. The outlet pipe from the fæcal container is fitted into the waste pipe of the bath so as to make an air-tight connection. The bath is now half-filled with water at a temperature

of about 99° F. The water container is filled with water at a temperature of 104° F., and sodium chloride or some other medicament added. The tubing is emptied of air and the pressure-control chamber regulated. The patient now undresses and fastens the hip belt firmly round the body, the posterior pads lying over the lumbar region, and the lateral parts of the belt just above the iliac crests. The belt can now be made more secure by a gentle inflation of its india-rubber cover. The patient now steps into the bath and remains at first in the erect position.

A suitable anal tube is chosen, lubricated, and screwed into its socket in the saddle. The patient separates the legs, bends forward, and draws the cheeks of the buttocks slightly apart with the hands. The operator now lifts the saddle and gently inserts the rectal catheter into the anus with one hand, while the saddle is supported with the other. Meantime the patient withdraws the hands from the buttocks. Still supporting the saddle with one hand, the operator now fastens the short posterior saddle straps to the hooks on the lumbar portion of the belt. With the other the longer straps from the front part of the saddle are now fixed on to the hooks on the abdominal part of the belt. The saddle is now adjusted so that it is comfortable. The three india-rubber pads on the under-surface of the saddle should be palpated, because the pressure will be greatest at these points, as they have to support the major part of the patient's weight. The patient now glides down into the bath, and the rubber supports of the saddle rest on the floor of the bath. The saddle outlet pipe is now fastened by a short length of thick rubber tubing to the fæcal conduit, and the sliding tube of the conduit is adjusted, being lengthened if the patient is sitting upright in the bath, and shortened if the patient is in the recumbent position. The saddle cushion is inflated with air and the straps of the saddle finally adjusted, also the foot-rest. The rubber tube from

the tank is now fastened to the catheter inlet tube on the saddle, and the anal spray inlet tube to the

FIG. 26.—Lateral View of Patient with the Saddle of the Subaqueous Intestinal Bath Apparatus attached, preparatory to the Commencement of Treatment.

water supply. The level of the water in the bath is now determined. Healthy patients prefer to have the

water up to their shoulders, especially during cold weather, while delicate patients may like the front of the chest to be out of the water.

The pressure-control chamber is regulated in exactly the same way as with the Studa chair. Irrigating fluid at the correct temperature is allowed to flow slowly through the rectal catheter into the bowel; evacuation generally occurs when about a pint of fluid has entered the bowel. Alternate entry and expulsion of fluid takes place until the returning fluid is quite colourless. The duration of the application is the same as that with the Studa chair, and the patient remains with the saddle in position for ten minutes or more after the tap of the reservoir has been turned off. The cloaca of the saddle is then flushed with a stream of water at a temperature of about 93° F., so that any fæcal matter which may have remained is removed.

The saddle is deflated and the front straps are detached and the belt removed. The patient stands up, leaving the saddle resting on the bottom of the bath, and a shower-bath can be taken if desired.

A commode or water-closet must be available near the bath, because the resumption of the erect position sometimes induces an urgent desire to empty the bowels of residual irrigation fluid.

The residue in the sieve in the fæcal container is examined, and then the pan is reversed by turning the outside handle, and the container is flushed out with hot water. The fæcal container is raised a little so that the small lever at the lower part of the outlet pipe falls downwards and allows the bath water to flow through the perforations in this pipe.

After the treatment the saddle and tubing are thoroughly sprayed and then boiled in a large steriliser, which is 18 in. long, 10 in. wide, and 9 in. deep.

There are certain difficulties which may arise in the course of a Subaqueous intestinal bath treatment. If colicky pains should occur in the bowels, the flow of

irrigation fluid should be temporarily stopped, and a hot spray over the abdomen will generally prove helpful. Great care must be taken to prevent any leakage from the saddle or fæcal conduit into the bath. If the air cushion of the saddle should become defective and allow the air to escape, it should be replaced. The rubber junctions of the fæcal conduit must be satisfactory.

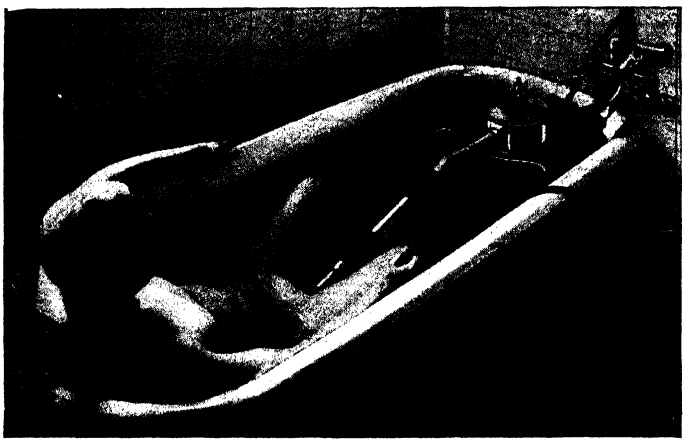

FIG. 27.—Patient having Treatment with the Subaqueous Intestinal Bath Apparatus.

Sometimes the patient moves to an undue extent and disturbs the attachments of the saddle.

On rare occasions, when a rectal catheter which has been too short is used, the catheter may slip out of the rectum; this accident should be expected when it is noticed that there is a constant stream of colourless water passing along the conduit. Should this occur, it will be necessary to detach the proximal end of the conduit from the saddle, and hold the end above the level of the water in the bath, and then undo the front straps of the saddle and deflate the saddle cushion. The rectal tube can then be reinserted.

Sometimes the rectal catheter may become blocked with fæces, but this occurs very infrequently. If it should take place, the rubber tube from the container should be disconnected from the irrigation tube of the saddle and replaced by a Higginson syringe, which is used to remove the obstruction by forcing water with considerable pressure through the catheter.

An interesting feature of the Subaqueous method of colonic lavage is the fact that the saddle is at a lower level than the fæcal container, and the expulsive force of the muscles of defæcation is sufficiently great to empty the fæcal conduit without difficulty.

Careful reports should be kept of each treatment which is given, and the provision of a special card for this purpose may be advantageous. The card should contain the following particulars :—

Surname and Christian name of the patient (in block letters).
Patient's address and telephone number.
Patient's age.
Name of patient's medical practitioner.
Diagnosis.
This is the " X " treatment.
Condition of bowels since last treatment.
Date and time of administration of treatment.
Position of patient during the treatment.
Irrigating fluid used.
Quantity.
Temperature.
Pressure.
Type of catheter used.
Number of evacuations—*circa*
Expulsive force.
Flatulence.
Condition of patient during the treatment.
Treatment given by
Next appointment arranged for

Fæces

Colour.
Character.
Odour.
Reaction.
Abnormal constituents.

CHAPTER VII

COLONIC LAVAGE, ITS PHYSIOLOGICAL EFFECTS; ALSO PRESCRIPTIONS OF THE VARIOUS MEDICAMENTS EMPLOYED

A VERY large number of different substances have at one time or another been administered in the form of enemas or clysters.

Some of these, at the present time, are only of historical interest. De Graaf made some shrewd comments on the composition of clysters. "Have we not seen," he says, "clysters composed of decoctions and other ingredients which did not work at all, while a clyster made simply of pure water, honey, and salt has worked marvels and passed as a great secret? Practitioners should pay great attention to this point, especially when attending the poor, so that too great expense is not incurred."

On the question of nutrient enemas, he says: "It is therefore reasonable to believe that the alimentary clysters are not so useful as some believe them to be, without saying that they are incapable of giving any strength to the body, since we see spirit and strength return every day by simple agreeable odours." "The sister of Hippocrates prevented him from dying during the solemn feast of Ceres, by making him smell hot bread for three days."

Many of the old prescriptions are rather amusing. Bates' "Dispensatory" (1694) gives the following formula for an enema dysentericum: "A clyster against the Bloody Flux. ℞ Take a sheep's head killed with the

wool and broken to pieces (the tongue and brains being taken out), boil it in water q.s. and strain out for clysters. You may add flowers of chamomile, mallows, and marsh mallows et cetera or it may be made of butter, not salted, 10 ounces, dragon's blood two drachms, red wine 2 ounces; or otherwise new milk 12 ounces, opium 1 scruple, saffron $1\frac{1}{2}$ drachms, being boiled add white sugar $1\frac{1}{2}$ ounces and the yolks of two eggs."

The Action of Enemas.—It may be helpful to summarise the different effects produced by enemata.

Psychical Effects.—A feeling of freshness and well-being is produced. The treatment is also calculated to create the impression in the patient's mind that it will have a curative action in his, or her, case, as the patient soon understands the technique of the treatment, and the value of the procedure is so apparent.

Physical Effects.—Mechanical (eliminative action).

Removal of Normal Bowel Contents and Cleansing of the Intestinal Mucous Membrane, including—

1. Undigested food particles.
2. Excretory products (salts of heavy metals).
3. Innocuous bacteria.
4. The waste products of normal bacterial growth.
5. Normal glandular secretions and cellular debris (desquamated intestinal mucous membrane cells).

Removal of Abnormal Bowel Contents and Consequent Protection of the Intestinal Mucous Membrane and the Body as a Whole.

1. Excessive mucus.
2. Casts of mucous membrane.
3. Harmful bacteria.
4. Ptomains.
5. Excessive quantities of intestinal gases.
6. Parasites.

7. Impacted fæces which the irrigating fluid has dissolved.
8. Poisonous substances, *i.e.*, lead, etc., in chronic intoxications.

The clearance of the bowel produces conditions which are unfavourable to the growth of harmful bacteria.

The Induction of Bowel Movements.—By stimulation of the muscular tissue of the bowel wall leading to—

1. Improved abdominal vascular and lymph circulation, with the elimination of splanchnic-vessel engorgement and an enhanced blood supply to the mucous membrane, digestive glands, etc.
2. The stimulation of food transport.
3. More perfect digestion due to vigorous churning and mixing of the food, and the increased discharge of digestive juices into the canal.
4. Increased absorption of food substances from the bowel.
5. The production of important reflex effects in the liver, pancreas, stomach, genito-urinary system, etc.

Digestion is therefore aided. Anorexia is often relieved. Movements of the stomach and small intestine are stimulated. The urinary system is thoroughly flushed out, an extra 600 c.c. of fluid often being excreted.

These actions render colonic lavage of great value in certain diseases of the stomach, pancreas, gall bladder, liver, kidneys, ureter, bladder, etc.

Thermal Action.—Thermal effects are produced by the use of hot and cold solutions. Hot enemas are sedative, whereas cold, stimulate peristalsis, and if unduly cold, may even produce violent contractions and severe colic. Enemas at a temperature of 60° to 70° are frequently used in febrile conditions.

Osmotic and Surface Tension Effects.—The osmotic action depends on the tonicity of the different solutions which are used.

Various substances influence surface tension in different ways.

Chemical Effects.

Chemical effects of liquids, gases, emulsions, substances in the colloidal state, foam, etc.

Water and normal saline do not produce any chemical changes, but other solutions may have—

A local action on the bowel and contents, which may be

Anodyne,
Anthelmintic,
Antiseptic,
Antispasmodic,
Antizymotic,
Astringent,
Carminative,
Dehydrating,
Demulcent,
Hæmostatic,
Purgative,
Sedative,
Solvent;

or a

General action on the system after absorption, which may be

Alterative,
Anæsthetic,
Depressant,
Diaphoretic,
Diuretic,
Hypnotic,
Narcotic,
Nutritive,
Stimulant.

The list of substances which have been used as irrigating fluids in colonic lavage is a very large one.

There are great differences of opinion in regard to the efficacy of intestinal disinfectants used in irrigating solutions.

Certain experiments have been performed at the Mayo Clinic. Various antiseptic substances were placed in ligatured intestinal loops, without sterilisation being obtained in a single case.

The following substances, which were all much stronger than could possibly be used in irrigation, were employed in the tests. Alcohol (70 per cent.), beta-naphthol, a saturated solution of chlorinated soda, creosol (2 per cent. solution), phenol (5 per cent. solution), silver nitrate (5 per cent. solution), thymol (10 per cent. solution in alcohol), zinc chloride (saturated solution).

There seems no doubt that the proved bactericidal action of solutions of such substances as monsol, dimol, etc., when employed in irrigation, is in large measure due to the thorough mechanical cleansing of the mucous membrane that occurs.

On the Continent, infusions of various plants are frequently used in irrigating solutions, and it has therefore been considered advisable to mention them. Infusions of chamomile are one of the most valuable of these preparations. Certain substances have also been included that are solely of historical interest.

When the quantity 1·7 pints is given, it generally means that the prescription is an American one, and that an American quart has been converted into its English equivalent, which is 1·7 pints.

The list of substances has been arranged in alphabetical order for purposes of reference.

Substances and Solutions used in Colonic Irrigation :—

Acidophilus Bacillus—Emulsion (soft paraffin, agar-agar, and emulsion of organisms). *B. acidophilus*

emulsion (Spicer) is stated to contain a minimum of 250 million viable *B. acidophilus* per cubic centimetre of mineral oil-agar emulsion.

Le Roy advises Mulford's liquid culture, 1 tube; lacto-dextrin, 1 oz.; water to 1·7 pints.

Acriflavine and Neutral Acriflavine—Diamino-methyl-acridinium chloride hydrochloride and methyl-acridinium hydrochloride. For irrigation 1 in 8,000 up to 1 in 4,000 as a maximum. Neutral acriflavine can be used as follows: 0·5 gr. in 3·4 pints of water, to which 109 to 218 gr. of sodium chloride have been added. Antiseptic.

Acriviolet—1·7 pints of a solution, 0·15 gr. to 1 gal., are used, and 1 pint of this is allowed to remain in the bowel for two to three minutes.

Adrenalin—$\frac{1}{2}$ to 1 oz. of a solution (1 in 1,000) can be used when there are hæmorrhoids.

Albargin (silver gelatose)—1 gr. to 1 oz., or 20 gr. can be used in 30 oz. of normal saline, and 25 oz. of this solution used for irrigation.

Alcohol—Ethyl alcohol. Antiseptic, astringent.

Almonds—Oil of sweet (*Amygdala dulcis*); demulcent used by De Graaf.

Aloes—Enema aloes (aloes 40 gr., potassium carbonate 15 gr., mucilage of starch 10 oz.).

Alum—Solution 0·5 per cent. used as an astringent (frequently with kaolin).

Aluminium Aceto-tartrate—One teaspoonful to 1 pint of water used as an astringent.

Ammonia—Enema ammoniæ (strong ammonia 1, water 160, 1 drachm to 1 pint) used in intestinal paresis, but not to be employed too frequently.

Ammonium Chloride—Dose by mouth 5 to 20 gr., 3 to 12 dg.

Ammonium Sulpho-ichthyolate—Dose by mouth 15 to 30 gr., 1 to 2 grm.

Anise Water (*Aqua anisi*).

Argyrol—0·5 per cent. solution. Protein compound

containing 30 per cent. silver; 1½ pints of a 1 per cent. solution have been used in ulcerative colitis.

Aristol (Dimethyl iodide).

Asafœtida—5 per cent. of tincture in a starch mucilage. Tinct. asafœtida 60 minims, starch enema to 4 oz.

Aseplene—A proprietary organic preparation containing formaldehyde.

Balsam of Peru—Must be emulsified before being used. Antiseptic.

Barium Sulphate—Different prescriptions are as follows: Barium sulphate 12 oz., mixed with kaolin and warm water. Barium sulphate 192 (6 oz.), methylated spirit 45 (1½ oz.), mucilage of gum acacia 20 (¾ oz.), distilled water to 900 (30 oz.). Barium sulphate 40 oz., tragacanth 60 gr., water to 80 oz., to be diluted with an equal amount of water at the time of use.

Barley Water—Used by De Graaf.

Belladonna—Extract 0·25 grm. to 30 litres (3·35 gr. to 6·6 gals.), or tincture of belladonna 2 to 3 grm. to 20 to 25 litres (34 to 51 minims to 4·4 to 5½ gals.).

Bile Extract—Fel bovinum purificatum. Enema 20 gr. to 1 to 2 oz. Useful in cases where there are impacted fæces when rectum is so full that there is no room for larger enema.

Birch—Infusion of, *Betula alba.*

Bismuth Carbonate—1 per cent. (insoluble in water), so suspended with tragacanth.

Bismuth Subcarbonate—½ oz. of mucilage, 6 oz. of water (lukewarm), 12 oz. used for ulcerative cases associated with irritation.

Bismuth Subgallate—Used suspended with starch.

Bismuth Subnitrate—3 drachms, sodium salicylate 2½ drachms, psyllium seeds mucilage to 1 pint, or can be suspended with starch.

Bolus Alba—Kaolin (aluminium silicate), ¼ to 1 oz. (8 to 30 grm.).

Boric Acid—2 pints of a saturated solution can be

used, or 1 teaspoonful to 1 litre. It is used for dissolving mucus.

Bran—Used by De Graaf.

Buckbean—March trefoil, infusion of, *Folia trifolii fibrini.*

Caffeine—Diuretic dose per os 2 to 10 gr.

Calcium Chloride—Irrigation to be carried out with solution 40 grm. (1 oz., 180 gr.) in 15 litres ($3\frac{1}{3}$ gals.), and then a solution 10 grm. (154·3 gr.) in 150 grm. of water (5·3 oz.) is introduced and retained in the bowel (Urbach).

Calomel—Subchloride of mercury; insoluble, so must be suspended. Dose per os $\frac{1}{2}$ to 5 gr.

Calumba—Infusion of; used for treatment of oxyuris infection ($\frac{1}{2}$ pint).

Caraway Fruit—Infusion of, *Carui fructus*; useful in flatulent colic.

Castor Oil Enema—Castor oil 2 oz., soft soap 1 oz., water to 20 fluid oz.

Cathartic Acid—Present in senna; acts on the colon.

Centaury—Erythræa centaurium; used in dyspepsia.

Chamomiles—Infusion of, *Matricaria chamomilla.* 30·9 gr. of powder in 1·7 pints of water.

Charcoal—Animal 15 grm. (231·5 gr.) in 5 litres (1 gal., $17\frac{1}{2}$ oz.).

Chicory—Infusion of.

Chinosol—Oxyquinoline sulphate, 0·6 gr. to 1·7 pints.

Chloral Hydrate Enema—10 to 40 gr. of chloral hydrate, starch enema to 1 oz.; 4 oz. used.

Cholalic Acid.

Coca Butter.

Collargol (1 per cent.)—10 grm. (154·3 gr.) in water 15 litres ($3\frac{1}{3}$ gals.) for irrigation; then 5 grm. (77·2 gr.) in 150 grm. (5·3 oz.) of water is used and allowed to remain in the bowel.

Colocynth and Colocynthin.

Coltsfoot—Decoction of, *Tussilaginis folia*; demulcent.

Comfrey, Great—Decoction of, *Symphyti radici*; used by De Graaf.

Copper Sulphate—Solution. Dose per os 3 to 4 gr.; astringent and hæmostatic.

Cotton-seed Oil (*Oleum gossypii seminis*)—4 to 12 oz.

Creosote Enema—Creosote 40 minims, well shaken for several minutes in 2 oz. of warm milk. If possible, enema to be retained for two hours.

Cretæ Preparata.

Cyllin (cresyllic compound)—Dose per os 1 to 5 minims (0·06 to 0·3 c.c.).; intestinal disinfectant.

Cystazol (hexamine and sodium benzoate).

Dandelion—Decoction of, *Taraxaci radix*; laxative.

Dermatol—52 to 57 per cent. of bismuth subgallate. Dose per os 1 to 3 grm. (15·4 to 46·3 gr.).

Dextrose—6 per cent. solution is isotonic with blood and is readily absorbed; 15 oz. are given four times a day. When used in a 10 per cent. solution, 99 per cent. is absorbed.

Digitalis.

Dill Fruit (*Aqua anethi*)—Used by De Graaf.

Dimol—Particulars of certain tests which were carried out with dimol are given at the end of this chapter.

Elderberries—Decoction of, *Sambucus ebulus.*

Emetine Hydrochloride—3 gr. in 1·7 pints.

Fennel (*Aqua fœniculi.*)

Formaldehyde—10 per cent. solution.

Frangulæ Cortex—Fluid extract of.

Fumitory—Infusion of, *Fumaria officinalis*

Garlic—Infusion of, *Allium sativum*; antispasmodic.

Gentian Violet—Strength 1 in 15,000.

Glucose Enema—1 oz. of glucose to 1 pint of normal saline.

Glycerine—4 drachms. The irritating effect is due to its dehydrating power; it may cause catarrhal proctitis.

Glycothymoline—5 per cent. solution.

Gum Arabic—Mucilage of, with weak decoction of starch.

Hexamethylenetetramine—10 gr. to 1 pint.

Hexyl Resorcinol—Alkyl derivative of resorcinol.

Honey—Solution of, *Mel depuratum*; demulcent and mild laxative.

Hops—Infusion of, *Humulus lupulus*, 1 to 2 oz.

Hydrochloric Acid—Solution of; dilute.

Hydrogen Peroxide—3 per cent. 3 grm. (50 minims) in 15 litres (3⅓ gals.) to be used for irrigation, and then 0·5 grm. (8·5 minims) in 150 c.c. (5·3 oz.) allowed to remain in the bowel. Used in fæcal impaction, amœbic dysentery, proctitis, ulcerative colitis, etc.

Ichthyol (*Ammonium ichthosulphonate*)—0·5 to 1·0 per cent. Should be first dissolved in a few drops of glycerine, and then 5 grm. (77·16 gr.) in 15 litres (3⅓ gals.) of water, and this solution should be allowed to remain in the bowel. Another prescription is as follows: An emulsion should be made by emulsifying 218 gr. in 2 drachms of kerosene, and then mixing it with 10 oz. of water at 37° C. The solution should never be used for irrigation, however, at a temperature above 30° C.

Iodine—Tincture of. Dose per os 1 to 2 minims of weak tincture.

Iron Carbonate—Saccharated solution of.

Iron Chloride—2 per cent. *Liquor ferri perchloridi fortis*; astringent.

Izal—Garrod investigated the effect of three different samples taken by the mouth. There was a decrease of 90 per cent., 8 per cent., and an increase of 150 per cent. in the number of organisms found. in the fæces, respectively.

Juniper Berries—Infusion of, *Juniperus communis*; diuretic.

Kamillosan (*liquidum*)—A preparation of chamomile flowers. Prescriptions are 4 drachms to 1¾ pints, and 5·6 drachms (20 c.c.) in 4·4 to 5·5 gals. of water (20 to 25 litres). Anodyne and mild disinfectant.

Kaolin—Colloidal kaolin. When used as enema, 50 per cent. by weight in warm water; another prescription is 1 teaspoonful in 1·7 pints of water. Is sometimes used with medicinal paraffin.

Kerol—Garrod found that kerol taken by the mouth increased the organisms in the fæces by 0·5 per cent.

Krameria—Tincture of, Rhatany root; 125 c.c. (4·4 oz.) of fluid extract of krameria and 8 grm. of sodium biborate (123·5 gr.); 1 drachm of this mixture is taken and added to 1·7 pints of water, which is used as the irrigating solution.

Lactic Acid—Dose per os 15 to 30 minims (1 to 2 c.c.), well diluted.

Lactis Yoghourt.

Lacto-dextrin—Lactose 73 per cent., dextrin 25 per cent.; 1 to 3 oz. before each meal.

Laurel Water (*Laurocerasi folia*)—Used by De Graaf. Contains dilute hydrocyanic acid.

Lead Acetate—1 per cent. solution is used as an astringent and hæmostatic.

Lime Blossoms (infusion of).

Lime Water (*Liquor Calcis*)—Dose per os 1 to 4 oz.; useful in oxyuris infection.

Linseed Tea—Infusion of, *Linum usitatissimum*; used as an emollient enema for soothing irritable rectal mucosa.

Lithium Aceto-salicylate, with sodium bromide. Lithium aceto-salicylate 10 gr., sodium bromide 1 drachm, distilled water to 5 oz.

Lysol—1½ parts in 1,000 of water.

Magnesium Chloride—Dose per os 30 to 60 gr.; purgative.

Magnesium Sulphate—½ to 2 oz. in 1 pint of water; purgative.

Male Fern—Extract of, *Dryopteris Filix-mas*; anthelmintic.

Mangosteen Rind—Decoction of.

Marigold—The common marigold florets. Infusion of *Calendula officinalis*.

Marshmallow Roots—Decoction of, *Althæa officinalis*; demulcent.

Melissa officinalis—Infusion of oil of lemon grass; carminative.

Mercurochrome—200 (prepared with normal saline and a few drops of dilute acetic acid). Contains 23 per cent. of mercury; a 1 per cent. solution is used.

Mercury Perchloride—0·01 to 0·5 per cent. solution.

Mergentheim Salts are extracted from the waters of Bad Mergentheim. They contain various chlorides and sulphates, and are alkaline and diuretic.

Methylene Blue—1 part in 15,000; a solution containing 2 to 3 gr. to 1 pint has been used for irrigation in ulcerative colitis.

Milk—Suggested by Manson for use in dysentery as an irrigating fluid.

Milk Thistle—Infusion of seeds of, *Semina cardui mariani*.

Mistletoe—Infusion of leaves of, *Viscum album*; purgative. Dose per os of liquid extract 15 to 60 minims.

Monsol—Can be used in solution 1 part in 160 parts of water; other prescriptions are 1 drachm to 3 pints of water, gradually increasing to 2 drachms to 3 pints of water (solutions of 1 in 500 and 1 in 250).

Mucilage—25 per cent. solution.

Naphthol α—2 to 5 gr.

Naphthol β—3 to 10 gr. per os. Often used at strength of 1 in 1,000; vermifuge.

Neo Kelpol (compound containing 0·5 per cent. of lactic acid)—1·7 pints of a solution containing 1 teaspoonful to 1 pint are generally used.

Neo Silvol—Solution, 22 to 100 gr., dissolved in 4 oz. of water. Temperature of solution should not exceed 50° C.

Oak Bark—Infusion of.

Oleosum—Enema. Olive oil 4, soft soap 1, warm water 16 parts.

Olive Oil—4 to 12 oz.

Opium—Tincture of, *Enema opii* (tincture of opium 30 minims, mucilage of starch 2 fluid oz.; 5 oz. of gruel is sometimes added).

Orange Blossoms—Infusion of, *Aqua aurantii flores.*

Pantopon (omnopon)—0·02-0·04 grm. (0·3-0·6 gr.).

Paraffin—Medicinal, *Paraffinum liquidum*; 2 to 3 oz. are frequently used for rectal injection.

Peppermint—Infusion of, *Mentha piperita*; antiseptic.

Phosphoric Acid—Contained in Overall's or Bullock's solution (phosphoric acid, hydrochloric acid, and potassium permanganate).

Pine Needles—Infusion of, *Pini pumilionis.*

Plantain Leaves—Infusion of, *Plantago lanceolata.* Can be added to the irrigating solution when hæmorrhoids are present.

Pomegranate Bark—Infusion of, *Punica granatum*; astringent, and for use in treatment of tapeworms. Contains the alkaloid *Pelletierine tannate.*

Potassium Bromide.

Potassium Chloride.

Potassium Permanganate—Can be used as an oxidising agent for destroying bacterial products. May be used 1 in 10,000, or 1 gr. in 1½ pints (0·66 gr. to the pint), and two injections given daily of 1 pint. One of the author's patients, however, found that 40 gr. to 8 gals. (0·66 gr. to the pint) produced irritation at the anus; 20 gr. to 8 gals. (0·33 gr. to the pint) had a similar, though less marked, effect, and finally a solution containing 10 gr. (0·165 gr. to the pint) was used.

Primrose—Infusion of flowers, *Primula vulgaris.*

Proflavine—1 gr. in 10 oz.; strongly bactericidal.

Protargol—1 per cent. solution. Protein compound containing 8 per cent. silver. Dose per os 1 to 3 gr.

Quassia—Infusion of; ½ pint can be injected into the rectum in oxyuris infection.

Quinine Hydrochloride—1 in 1,000 solution.

Quinine Sulphate—Enema. Quinine 20 gr., alcohol 45 minims, ether 2½ oz., olive oil to 4 oz.

Quinoxyl—Iodohydroxyquinolinesulphonic acid 80 per cent., sodium bicarbonate 20 per cent.; 5 grm. (77·2 gr.) are dissolved in 200 c.c. (7·04 oz.) of water, which has been boiled and allowed to cool to about 60° C. This produces a 2½ per cent. solution; it is then allowed to cool to body temperature, and injections of 200 c.c. (7·04 oz.) can be given on ten consecutive days.

Radium Emanation—100,000 mgms. in 15 litres (3⅓ gals.) are used for irrigation, and then 150 grm. (5·3 oz.) containing 20,000 mgms. are allowed to remain in the bowel.

Resorcinol (metadihydroxybenzene)—Solubility 1 in 1 of water. Solution used for irrigation 44 gr. to 1·7 pints.

Ricini Olei Enema—Castor oil 1, olive oil 4, dose 5 to 10 oz.

Ricinoleic Acid.

Saccharum Purificatum—Sucrose.

Saffron—Infusion of, *Crocus sativus*; used by De Graaf.

Sage—Infusion of salvia; carminative.

Salicylic Acid—Solution 1 in 1,000.

Saline Normal—Sodium chloride 0·9 per cent., approximately 80 gr. to 1 pint of boiled water should only be used in small amounts at this strength. When continuous irrigations are used, 2 oz. of salt to 8 gals. of water is sufficient.

Salol—Phenyl salicylate. Dose per os 5 to 15 gr.; intestinal disinfectant.

Santonin Powder—Solution 4 gr. to 1 pint can be used as an irrigating fluid for oxyuris vermicularis infection.

Saponified Oil—Used by Le Roy, consists of vegetable fats almost neutral in reaction.

Sapo Medicatus.

Sea Water—Used by De Graaf.

Senna—*Infusum sennæ* contains cathartic acid, which acts on the colon.

Shave Grass—Infusion of, *Equisetum arvense.*

Shepherd's Pouch—Infusion of, *Capsella bursa pastoris.*

Silver—Colloidal for irrigation 1 in 8,000.

Silver Gelatose—Albargin 1 gr. to 1 oz. Amount used for irrigation 1 to $1\frac{1}{2}$ pints.

Silver Nitrate—$\frac{1}{2}$ to 1 grain to 1 oz. of distilled water; must only be applied in dysentery when the acute symptoms have disappeared. An enema of 3 to 4 pints of warm water, containing 2 to 3 teaspoonfuls of sodium carbonate, can then be used, and when the bowel is empty, 2 to 3 pints of the silver nitrate solution can be injected every few days.

Sodium Acetate—Can be employed for dissolving mucus. Dose per os 15 gr.

Sodium Acid Phosphate—NaH_2PO_4 solution used, 218 gr. to 1·7 pints. Has acid reaction.

Sodium Benzoate—Dose per os 5 to 30 gr.; antiseptic.

Sodium Biborate—Dose per os 5 to 20 gr.

Sodium Bicarbonate—1 to 2 drachms dissolved in 1 pint of water, 2 to 3 pints being used. It has been suggested that it frequently generates large quantities of gas.

Sodium Bromide—10 grm. (154·3 gr.) dissolved in 15 litres ($3\frac{1}{3}$ gals.) of water is used for irrigation, and then a solution of 3 grm. (46·3 gr.) in 150 grm. (5·3 oz.) of water is allowed to remain in the bowel.

Sodium Carbonate—Solution 60 gr. to 1·7 pints is used for dissolving mucus.

Sodium Chloride—Simple colonic wash; contains 1 drachm to 1 pint (1 oz. to 1 gal.). It has been

suggested that it occasionally creates thirst, but this has not been the author's experience.

Sodium Hypochlorite—1 per cent. solution. *Liquor sodæ chlorinatæ* used for irrigation when diluted with 15 to 60 times its volume of water.

Sodium Neutral Phosphate—Na_2HPO_4. Salt in solution is neutral.

Sodium Normal Phosphate—Na_3PO_4. Tertiary or alkaline phosphate. Salt in solution is alkaline.

Sodium Salicylate—Solution for irrigation contains 10 grm. (154·3 gr.) in 15 litres (3⅓ gals.); then 150 grm. (5·3 oz.) of a solution containing 5 grm. (77 gr.) is allowed to remain in the bowel. The solution is alkaline.

Sodium Silicate—Solution for irrigation contains 50 grm. (1 oz., 334 gr.) in 15 litres (3⅓ gals.) of water; then 150 grm. (5·3 oz.) of water containing 10 grm. (154·3 gr.) is allowed to remain in the bowel.

Sodium Sulphate—Dose per os ¼ to ½ oz.

Sodium Thiosulphate (or *Sodii hyposulphis*)—Solution of 20 grm. (308·2 gr.) in 15 litres (3⅓ gals.) of water is used for irrigating purposes; then 150 grm. (5·3 oz.) of water containing 10 grm. (154·3 gr.) of sodium thiosulphate is allowed to remain in the bowel. It is useful in hyperpiesis associated with nephritis.

Sprudel Salts (from Karlsbad)—Sodium sulphate, sodium hydrocarbonate, calcium hydrocarbonate, sodium chloride, etc.

Starch (Amylum)—Mucilage of starch is used in various enemata.

Stovarsol (Acetyloxyaminophenyl-arsenic acid)—Dose per os 4 gr.; used in amœbiasis, lambliasis, etc.

Strychnine—Tincture of, 1 grm. (16·95 minims) in 15 litres (3⅓ gals.).

Sulphur—Colloidal.

Sulphur Diasporal A—Klopfer; 20 grm. (308·6 gr.) in 15 litres (3⅓ gals.) of water are used for irrigation; then 150 grm. (5·3 oz.) of water containing 10 grm.

(154·3 gr.) of sulphur diasporal A are injected and allowed to remain in the bowel.

Tannic Acid—1 teaspoonful is dissolved in 1 pint of water. It is used for its astringent properties. Has also been used with strength of 30 gr. to 1 quart.

Terrasal—1 gr. dissolved in 1 gal. of water.

Thymol—1 drachm of an alcoholic solution dissolved in 1·76 pints (1 litre) of water; disinfectant, anthelmintic.

Trivalin—Solution of valerianic acid, with morphine valerianate $\frac{1}{3}$ gr., caffeine valerianate $\frac{1}{18}$ gr., and cocaine valerianate $\frac{1}{12}$ gr., in 1 c.c. Dose by the mouth 0·5 c.c. (8 minims) three times a day.

Turpentine—Oil of, enema terebinthæ. Oil of turpentine 6·25 parts, mucilage of starch to 100 parts; 16 fluid oz. are injected; used for tympanites and as an anthelmintic.

Ulmi Fulvæ Enema—Slippery elm, 350 gr. of powder dissolved in 16 fluid oz. of water; demulcent.

Uvæ Ursi Folia—Infusion of, Bearberry leaves; diuretic. Dose per os $\frac{1}{2}$ to 1 drachm.

Valerian—Infusion of, Valerianæ rhizoma; useful in flatulence.

Yarrow—Infusion of, Milfoil.

Yatren—Iodo-oxyquinoline sulphuric acid, with sodium bicarbonate. For rectal injection yatren 105 puriss is dissolved in water at 80° C. It is given as an enema at body temperature: 1 grm. (15·4 gr.) in 200 c.c. (7·04 oz.) increased to 2 grm. (30·9 gr.) in 300 c.c. (10·56 oz.), 3 grm. (46·3 gr.) in 400 c.c. (14·08 oz.), 4 grm. (61·7 gr.) in 500 c.c. (17·6 oz.), and 5 grm. (77·2 gr.) in 600 c.c. (1 pint, 1·12 oz.) and 800 c.c. (1 pint, 8·16 oz.).

Zonite—1 oz. dissolved in 1·7 pints.

A number of prescriptions for solutions to be used in various conditions are as follows:—

1. *Normal Saline.*

Approximately 80 gr. to 1 pint of water, 8 oz., 340 gr. to 6 gals.

2. *Normal Solution.*

Sodium chloride . .	50 grm. (1 oz., 334 gr.).
Potassium chloride .	1 „ (15·4 gr.).
Calcium chloride . .	1 „ (15·4 „).
Sodium bicarbonate .	3 „ (46·3 „).
Water to . . .	20 to 25 litres (4·4 to 5·5 gals.).

3. *Ringer's Solution.*

Sodium chloride . .	160 grm. (5 oz., 292 gr.).
Potassium chloride .	0·15 „ (2·3 gr.).
Calcium chloride . .	2 „ (30·9 „).
Sodium bicarbonate .	2 „ (30·9 „).
Distilled water to . .	20 litres (4·4 gals.).

In Bock's solution magnesium chloride is substituted for sodium bicarbonate, and in Thiess's solution sodium bicarbonate is omitted.

4. *Locke's Solution.*

Sodium chloride . .	180 grm. (6 oz., 163 gr.).
Potassium chloride .	8·4 „ (129·6 gr.).
Calcium chloride . .	4·8 „ (74 „).
Sodium bicarbonate .	10 „ (154·3 „).
Dextrose . . .	20 „ (308·6 „).
Water to . . .	20 litres (4·4 gals.).

5. *Solution recommended by Borosini.*

Sodium chloride . .	50 grm. (1 oz., 334 gr.).
Potassium chloride .	10 „ (154·3 gr.).
Calcium chloride . .	10 „ (154·3 „).
Magnesium chloride .	10 „ (154·3 „).
Water to . . .	25 litres (5·5 gals.).

6. *Solution for use in Toxic Dermatoses.*—Hydrogen peroxide 33 per cent., 3 c.c. (50·8 minims) in 15 litres (3·3 gals.) to be used for irrigation, and then 150 c.c. (5·3 oz.) of water are mixed with 0·5 c.c. (8·5 minims) of hydrogen peroxide, and this is injected and allowed to remain in the bowel (Urbach).

7. *Solution for use in Dermatoses due to Absorption of Toxic Products, also in Old-standing Cases of Salvarsan Poisoning, Burns, etc.*—Animal charcoal 15 grm. (231·5 gr.) in 5 litres (1 gal., 17½ oz.) of water.

8. *Solution for use in Dermatitis due to Salvarsan, Bismuth, Mercury, and Arsenic, and in Burns.*—Sodium thiosulphate (Beiersdorf) 20 grm. (308·6 gr.) dissolved in 15 litres (3·3 gals.) of water, to be used for irrigation; then 150 grm. (5·3 oz.) of water containing 10 grm. (154·3 gr.) of sodium thiosulphate are injected and allowed to remain in the bowel (Urbach).

9. *Solution for use in Bromine and Iodine Acne.*—Sodium chloride 40 grm. (1 oz., 180 gr.) dissolved in 15 litres (3·3 gals.) of water, to be used for irrigation; and then 10 grm. (154·3 gr.) are dissolved in 150 c.c. (5·3 oz.) of water, and this is injected and allowed to remain in the bowel (Urbach).

10. *Solution for use in Chronic Constipation associated with Prolonged Drug Taking, Meteorism, Anæmia, etc.*

Medical soap . . .	0·5 grm. (7·7 gr.).
Pure turpentine, with saccharated iron oxide . .	0·1 „ (1·5 „).
Ammonium ichthyolate .	1·0 „ (15·4 „).
Water to	20 litres (4·4 gals.).

11. *Enema catharticum.*

Magnesium sulphate . . .	6 parts.
Olive oil	6 „
Mucilage of starch . . .	90 „

15 fluid oz. are injected.

12. *Solution for use in Constipation due to an unsuitable Dietary (Avitaminosis).*

Lactis Yoghurt .	500 grm. (1 lb. 1 oz., 338 gr.).
Sugar . . .	200 „ (7 oz.).
Ammonium chloride	10 „ (154·3 gr.).
Water to . .	20 litres (4·4 gals.).

13. *Solution for Dermatoses due to Atonic Constipation.* The strychnine has a tonic action on the intestinal musculature.—Tincture of strychnine 1 c.c. (16·95 minims) in 15 litres (3·3 gals.).

14. *Solution for use in Spastic Constipation.*—Before the irrigation is commenced, 50 c.c. (1 oz., 6 drachms, 7 minims) of medicinal paraffin are injected into the bowel. Then irrigation is carried out with the following solution :—

Sodium chloride . .	30 grm. (1 oz., 25·5 gr.).
Potassium chloride . .	0·5 „ (7·7 gr.).
Calcium chloride . .	0·5 „ (7·7 „).
Tincture of belladonna .	3 c.c. (50·8 minims).
Water to . . .	20 to 25 litres (4·4 to 5·5 gals.).

15. *Solution for use in Spasmodic Constipation.*

Kamillosan . . .	20 c.c. (5 drachms, 39 minims).
Tincture of belladonna .	2 c.c. (33·9 minims).
Water to . . .	20 litres (4·4 gals.).

16. *Solution for Tenesmus and Sphincter Cramp.*

Calcium chloride . .	10 grm. (154·3 gr.).
Magnesium chloride . .	5 „ (77·2 „).
Sodium bicarbonate . .	5 „ (77·2 „).
Pantopon . . .	0·04 „ (0·6 „).
Tincture of belladonna .	3·0 c.c. (50·8 minims).
Water to . . .	20 litres (4·4 gals.).

17. *Solution for Constipation during Pregnancy and for Patients who are especially fond of Salt.*

Calcium chloride . .	20 grm. (308·6 gr.).
Potassium chloride . .	20 „ (308·6 „).
Magnesium chloride . .	20 „ (308·6 „).
Water to . . .	25 litres (5·5 gals.).

18. *Solution for use in Gout (Uric Acid Diathesis).*

Sodium salicylate . .	2 grm. (30·9 gr.).
Ammonium chloride .	2 „ (30·9 „).
Water to . . .	20 litres (4·4 gals.).

19. *Alkaline Solution for use in Acidosis (Schellberg).*

Sodium salicylate	218·7 gr.
Sodium phosphate	½ lb.
Water to	1·7 pints.

20. *Solution for use in Hyperacidity.*—This condition is frequently caused by constipation, and disappears when this is dealt with; 2 to 5 treatments at intervals of 1 to 2 days are generally sufficient.

Sodium chloride . .	20 grm. (308·6 gr.).
Potassium chloride . .	0·5 „ (7·7 „).
Calcium chloride . .	0·5 „ (7·7 „).
Tincture of belladonna .	2 c.c. (33·9 minims).
Water to . . .	20 litres (4·4 gals.).

21. *Acid Solution for use in Cases with Putrefaction (Schellberg).*

Potassium permanganate . .	3·4 gr.
Hydrochloric acid . . .	2·8 minims.
Phosphoric acid (85 per cent.) .	1·4 „
Water to	1·7 pints.

This solution should never be used at a temperature which exceeds 40° C., and should always be followed by the administration of strong purgatives.

Le Roy gives the following prescription :—

Potassium permanganate . .	1 oz.
Hydrochloric acid . . .	6 drachms.
Phosphoric acid . . .	3 „

Water to 1 gal., but the solution to be diluted further before being used for irrigation.

22. *Solution for use in Cardiac Arrhythmia (Heart Block).*

Potassium bromide . .	5·0 grm. (77·2 gr.).
Tincture of digitalis . .	1·0 „ (15·4 „).
Pantopon . . .	0·02 „ (0·3 „).
Hydrogen peroxide (33 per cent.)	2·0 „ (33·9 minims).
Water to . . .	20 litres (4·4 gals.).

23. *Solution for use in Muscular Rheumatism.*

Sodium salicylate . .	2 grm. (30·9 gr.).
Tincture of opium . .	1 c.c. (16·95 minims).
Water to . . .	20 litres (4·4 gals.).

24. *Solution for use in Acne vulgaris and Rosacea.*—Ichthyol is dissolved in a few drops of glycerine, 5 c.c. (1 drachm, 24·75 minims) is mixed with 15 litres (3·3 gals.) of water and used as the solution for irrigation; afterwards 150 c.c. (5·3 oz.) of water, containing 1 c.c. (16·95 minims) of ichthyol, are injected and allowed to remain in the bowel (Urbach).

25. *Solution for use in Furunculosis and Acne vulgaris.*—Sulphur diasporal A (Klopfer) 20 c.c. (5 drachms, 38 minims) is mixed with 15 litres (3·3 gals.) of water and used as the irrigating solution; 150 c.c. (5·3 oz.) of water, containing 10 c.c. (2 drachms, 49 minims) of sulphur, are then injected into the bowel and allowed to remain (Urbach).

26. *Solution for use in Septic Dermatoses.*—Collargol 10 c.c. (2 drachms, 49 minims) is mixed with 15 litres (3·3 gals.) of water and used as the irrigating solution; 150 c.c. (5·3 oz.) of water, containing 5 c.c. (1 drachm, 24·5 minims) of collargol, are then injected into the bowel and allowed to remain (Urbach).

27. *Solution for use in Erythema exudativum multiforme, Erythema nodosum, Purpura rheumatica.*—Sodium salicylate 10 grm. (154·3 gr.) is dissolved in 15 litres

(3·3 gals.) of water and used as the irrigating solution; 150 c.c. (5·3 oz.) of water, containing 5 grm. (77·2 gr.) of sodium salicylate, are then injected into the bowel (Urbach).

28. *Solution for use in Purpura hæmorrhagica.*—Calcium chloride 20 grm. (308·6 gr.) is dissolved in 15 litres (3·3 gals.) of water and used as the irrigating solution; 10 grm. (154·3 gr.) of calcium chloride is dissolved in 150 c.c. (5·3 oz.) of water, and this solution is injected into the bowel (Urbach).

29. *Solution for use in Arthritis psoriatica.*—Radium emanation 100,000 mg. dissolved in 15 litres (3·3 gals.) is used as the irrigating solution; 20,000 mg. of emanation dissolved in 150 c.c. (5·3 oz.) is then injected and allowed to remain in the bowel (Urbach).

30. *Solution for use in Lichen urticatus of Vasomotor Origin, and in Pruritus associated with Neurasthenia.*—Sodium bromide 10 grm. (154·3 gr.) dissolved in 15 litres (3·3 gals.) is used as the irrigating solution, and then 150 c.c. (5·3 oz.) of water, containing 3 grm. (46·3 gr.) of sodium bromide, is injected into the bowel and allowed to remain (Urbach).

31. *Solution for use in Pruritus senilis.*—Sodium silicate, 50 c.c. (1 oz., 6 drachms, 7·5 minims) of a 1 per cent. solution is mixed with 15 litres (3·3 gals.) and used as the irrigating solution, and then 150 c.c. (5·3 oz.) of water containing 10 c.c. (2 drachms, 49·5 minims) is injected and allowed to remain in the bowel (Urbach).

32. *Solution for use in Dysmenorrhœa.*

Lactis Yoghurt .	500 grm. (1 lb., 1 oz., 338·6 gr.).
Sugar . . .	200 „ (7 oz.).
Ammonium chloride	10 „ (154·3 gr.).
Water to . .	20 litres (4·4 gals.).

33. *Solution for use in Post-dysenteric Colitis (mild cases).*

Sodium chloride .	20 grm. (308·6 gr.).
Calcium chloride .	5 „ (77·2 „).
Liquor ferri sesquichloride, 10 per cent. . . .	5 c.c. (1 drachm, 24·7 minims).
Sodium bicarbonate	10 grm. (154·3 gr.).
Water to . .	20 litres (4·4 gals.).

Five litres of the irrigating fluid should be used each day while the diarrhœa persists; as soon as formed stools appear, treatment should be given only every third day.

The duration of the treatment is usually four to six weeks.

34. *Solution for use in Severe Cases of Post-dysenteric Colitis.*—Decoction of chamomile flowers 5 grm. (77·2 gr.) in 200 c.c. (7·1 oz.) of water, containing 0·5 grm. (7·7 gr.) of sodium bicarbonate.

Potassium bromide .	2 grm. (30·9 gr.).
Saccharated oxide of iron	0·5 „ (7·7 „).
Tincture of opium . .	2 „ (33·9 minims).
Water to . . .	20 litres (4·4 gals.).

35. *Solution for use in Chronic Proctitis and Periproctitis.*

Calcium chloride . .	10 grm. (154·3 gr.).
Magnesium chloride .	5 „ (77·2 gr.).
Pantopon . . .	0·02 „ (0·3 „).
Water to . . .	20 litres (4·4 gals.).

36. *Solution for use in Cases of Gastric Ulcer with slight Pain.*

Sodium chloride . .	20 grm. (308·6 gr.).
Potassium chloride .	0·5 „ (7·7 „).
Calcium chloride . .	0·5 „ (7·7 „).
Sodium bicarbonate .	2 „ (30·9 „).
Water to . . .	20 litres (4·4 gals.).

37. *Solution for use in Cases of Gastric Ulcer with considerable Pain.*

Magnesium chloride	10 grm. (154·3 gr.).
Tincture of belladonna	2 ,, (30·9 ,,).
Collargol, 1 per cent.	5 ,, (77·2 ,,).
Water to	20 litres (4·4 gals.).

With continued pain, pantopon 0·04 grm. (0·6 gr.) should be added; this amount can be increased up to 0·10 grm. (1·5 gr.).

38. *Solution for use in Fermentative Dyspepsia.*

Ichthyol (pure)	2 grm. (30·9 gr.).
Tincture of iodine	10 drops.
Sodium chloride	20 grm. (308·6 gr.).
Water to	20 litres (4·4 gals.).

39. *Solution for use in Cholecystitis and Pyelonephrosis.*

Hexamethylenetetramine	10 grm. (154·3 gr.).
Formaldehyde, 10 per cent. solution	1 c.c. (16·95 minims).
Water to	20 litres (4·4 gals.).

40. *Solution for Cases of Renal Gravel and Renal Calculus.*

Tincture of belladonna	2 grm. (33·9 minims).
Kamillosan	20 c.c. (5 drachms, 39 minims).
Sodium chloride	40 grm. (1 oz., 180 gr.).
Water to	20 to 25 litres (4·4 to 5·5 gals.).

41. *Solution for use in Pyelitis (mild cases).*

Calcium chloride	5 grm. (77·2 gr.).
Magnesium chloride	1 ,, (15·4 ,,).
Sodium bicarbonate	5 ,, (77·2 ,,).
Water to	20 litres (4·4 gals.).

42. *Solution for use in Treatment of Ureteric calculi.*

Sodium chloride .	40 grm. (1 oz. 180 gr.).
Kamillosan .	20 c.c. (5 drachms, 39 minims).
Tincture of belladonna . .	2 ,, (33·9 minims).
Water to . .	20 litres (4·4 gals.).

43. *Solution for use in Chronic Prostatitis.*

Kamillosan .	20 c.c. (5 drachms, 39 minims).
Tincture of belladonna . .	3 c.c. (50·8 minims).
Tincture of opium	2 ,, (33·9 ,,).
Water to . .	20 litres (4·4 gals.).

Oxygen Foam Treatment.—Oxygen foam is sometimes used for colonic irrigation. The foam is made by bubbling compressed oxygen through a special distributor, which is immersed in warm water containing a small amount of liquid extract of quillaia bark. The distributor is generally made of a number of flat, rhomboidal blocks of a specially prepared porous wood, and through each block a perforated tube passes which is connected with the supply tube from the oxygen cylinder. The blocks are enclosed in a cylindrical metal container. The compressed gas escapes through the minute natural pores of the wood in the form of extremely small bubbles, and forms masses of snow-like foam which gradually commence to flow from the outlet tube of the apparatus. The foam itself is neutral in reaction, and though it is not itself absorbed by the intestinal mucous membrane, it aids greatly the absorption of the other substances which may be incorporated with it. The foam gently fills the cavity of the bowel, and the minute bubbles enter the pores of the mucous membrane and liberate the oxygen. The foam cleanses the mucous membrane, removing all the mucus and foreign matter. It is necessary to have a three-way

device connected to the outlet tube of the container when applying colonic irrigation, as it is essential to mix the foam with water, as dry foam used alone does not provoke peristaltic movements. A mixture of foam and water is therefore first of all introduced into the rectum. The foam itself rises to the surface of the water in the bowel and, gently expanding, causes certain obstructions to disappear. Any fæcal masses present are broken up into very small fragments and their expulsion from the bowel aided. When the effluent becomes colourless, dry oxygen foam is introduced into the bowel until the patient experiences a desire to defæcate. The injection is then discontinued, a little foam is evacuated, and the residue allowed to remain in the bowel until it collapses. Medicaments can be introduced either in the foam itself or in the irrigating solution.

Experiments Performed to Test the Bactericidal Properties of Dimol when used in Colonic Irrigation.—Some time ago certain claims were made on behalf of a preparation, dimethylomethoxyphenol ($C_6H_2(CH_3)_2(OCH_3OH)$, in combination with the tri- and tetramethylophenols), known by the abbreviated name, "Dimol." It was suggested that this preparation had important properties of intestinal disinfection, and that the addition of a small quantity of dimol to the irrigating fluid used during colonic lavage resulted in the sterilisation of the colonic tract.

Consequently, for nearly two years, the author used dimol in a variety of cases, such as chronic dysentery, sprue, mucous colitis, intestinal worms, auto-intoxication, etc. The method employed was to add 2 pints of concentrated dimol solution (made by mixing 1 to 4 oz. of dimol powder with cold water so as to form a paste, and then adding boiling water) to the container holding the 8 gals. of slightly hypotonic saline solution. The results which followed this procedure were very encouraging, and old-standing dysenteric cases rapidly showed

improvement, and soon cleared up entirely. It seemed fair to conclude that these cases were cured by the disinfection of the bowel which followed the irrigation with the dimol solution. Lavage with saline alone did not yield such striking clinical results.

These facts encouraged the author to investigate the matter further. Although colonic lavage, particularly when carried out with one of the appliances incorporating marked improvements over the old Plombières apparatus, is an effective and accepted method of treatment in a large number of conditions, it does not result in the production of a sterile colonic tract. These methods effectively empty the bowel of fæcal matter, they also re-educate the bowel musculature, and stimulate the arterial, venous, and lymph circulation of all the abdominal organs. But the saline has no bactericidal properties. The majority of the colonic organisms, it is true, are removed mechanically by these methods, but a proportion remain and rapidly multiply. If the ordinary solution could produce a sterile tract, it would constitute an efficient method of treating the many inflammatory lesions of the bowel.

Three years ago the author and his wife carried out a test with the Borosini method of colonic lavage. The fæcal bucket and mackintosh sheets used in this method were sterilised, and the patient was irrigated with the ordinary hypotonic saline solution, and the following day with the saline plus dimol—1½ oz. of dimol powder being added to the saline in the 6-gal. tank—approximately 0·7 gr. per ounce. A small quantity of the irrigating fluid which had collected in the fæcal bucket at the end of the first treatment was placed in a sterile wide-mouthed 2-oz. bottle, and corked. The same procedure was carried out the next day with the dimol solution. On the day following each irrigation, 1 c.c. of each of these samples of fluid was plated on glucose agar contained in Petri dishes,

and incubated at 37° C. for twenty-four hours. The illustration on this page shows the results. The saline irrigating fluid yielded a marked confluent growth of colon bacilli, whereas the dimol irrigating fluid was sterile.

The finding was discussed with several bacteriologists, and some doubt was expressed regarding the result of the experiment. The important point was stressed

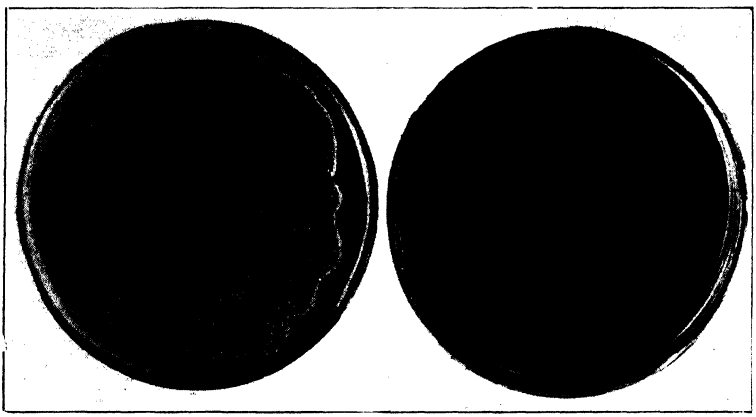

FIG. 28.—Culture Plates Incubated with Irrigation Fluid. Left-hand plate shows marked growth of *B. coli* in saline irrigation fluid. Right-hand plate shows complete absence of growth in irrigation fluid containing dimol. (0·7 gr. per ounce.)

that the saline irrigation would probably remove the majority of the micro-organisms in the colon, and that before the second irrigation was carried out, the colon would be in an almost sterile condition. It was suggested that it would be much more satisfactory to repeat the experiment, making the two irrigations on different subjects, one patient being irrigated with dimol solution, and another patient acting as a control, and being irrigated solely with saline solution.

Fortunately, it was possible to obtain the co-operation of Dr Cuthbert Dukes, on whose advice the new method of procedure was drawn up.

It was decided to administer colonic irrigation to two separate patients, one being treated with dimol solution, and the other, the control, with a slightly hypotonic saline solution. The Studa chair method of colonic lavage was used in each case, the rectal catheter being boiled before use. The Studa chair method differs from the Borosini method in that it has no fæcal bucket, and the effluent discharges directly into the soil pipe. It was therefore decided to collect samples fifteen, twenty, and thirty minutes from the commencement of the irrigation, by placing a wide-mouthed sterile bottle, fitted in a wire holder, over the cloaca of the apparatus.

The collection of the samples of the effluent liquid proved a little more difficult than was the case with the Borosini apparatus, but there was the advantage that specimens were obtained at intervals during the course of the irrigation, and not solely at the end of the application.

On 3rd March 1931 irrigation was carried out with saline solution containing $3\frac{1}{2}$ oz. of dimol powder (1·2 gr. per ounce).

Dr Dukes' report is as follows :—

Specimen.	*Bacteria per c.c.*	*B. coli per c.c.*
15 mins.	10	0
20 ,,	4	0
30 ,,	1	0

" The bacteria present in specimens marked 15 mins. and 20 mins. were atypical coliform bacilli of the *B. subtilis* and *B. mesentericus* group. You will see that there were no *B. coli* and practically no other bacteria in these specimens.

" Before drawing any conclusions as to the antiseptic power of dimol, I should like to know how many bacteria would be present in the bowel irrigation in which no antiseptic has been used."

The control, which was carried out on 5th March 1931, gave the following results :—

Specimen.	*Bacteria per c.c.*	*B. coli per c.c.*
15 mins.	More than 2,000.	Approximately 800.
30 „	„ „	„ 1,000.

Dr Dukes suggested that a cause of error might have arisen in this experiment, owing to the fact that the samples of irrigating fluid were not plated and incubated until the following day, and that any bacteria in the dimol solution might have been killed by their prolonged immersion in the solution. It was therefore decided to repeat the experiment and incubate the samples immediately after the termination of the irrigation. On 20th March 1931 a dimol solution of 4 oz. to 8 gals. (approximately 1·4 gr. per ounce) was used, and the report was as follows :—

Specimen.	*Bacteria per c.c.*	*B. coli per c.c.*
15 mins.	5	0
20 „	3	0
30 „	2	0

The control gave the following results :—

Specimen.	*Bacteria per c.c.*	*B. coli per c.c.*
15 mins.	More than 2,000.	50.
20 „	„ „	More than 2,000.
30 „	„ „	Approximately 1,000.

In reference to the numbers of *B. coli*, in the control experiment, it should be remembered that there was considerable variation in the character of the material entering the collecting vessels. Sometimes solid fæcal matter was collected, and when this occurred, the number of organisms was naturally likely to prove greater.

These results show that dimol can be employed advantageously in a variety of conditions where bacterial infection is present.

CHAPTER VIII

CONTRA-INDICATIONS AND SUGGESTED DANGERS OF COLONIC LAVAGE

THE number of conditions in which colonic lavage should not be given is small. The conditions may be either general or local. General contra-indications to colonic lavage are as follows :—

1. Where there is severe cardiac weakness and there is a danger of syncope.
2. Severe arteriosclerosis associated with high blood pressure. In these cases there is a risk of producing cerebral hæmorrhage, owing to the fact that blood is driven from the splanchnic area into the general circulation.
3. Where there is profound anæmia and weakness.
4. Persons with an idiosyncrasy to enemas, and who experience nausea, cold sweats, vomiting, and violent abdominal pain, and where colonic lavage by the Plombières method increases debility. (Some vasomotor abnormality is probably present in these cases.)
5. Severe cases of exophthalmic goitre.
6. Cases with severe pyrexia.

Local Conditions in which Colonic Lavage is Contra-indicated.

(*a*) Acute anal eczema.
(*b*) Stricture of the anus.
(*c*) Certain cases of hæmorrhoids.
(*d*) Acute ulcerative conditions of the colon of a severe character.

There is another group of cases in which it is necessary to exercise great care when they are treated by colonic irrigation. They are as follows :—

1. Nephritis and nephrosis, especially when associated with heart or circulatory disorders.
2. When there is weakening of the bowel wall and a danger of perforation in acute ulcerative colitis, diverticulitis, post-dysenteric ulceration, etc.
3. When a risk of causing gastric or intestinal bleeding exists in gastric ulcer, severe dysentery, etc.
4. When there is marked dilatation of the bowel.

A Number of Dangers which might arise from Enema Treatment have been suggested.

Local Conditions—

1. (*a*) The production of local injuries to the bowel wall, such as abrasions of the mucous membrane by the passage of an unsuitable rectal tube, especially one which is too hard or too long.
   (*b*) The irritation of the anal region by the too frequent use of enemas.
   (*c*) The development of hæmorrhoids after excessive irrigation.
2. The distension of the bowel, causing colic and also stretching of the circular muscle fibres and prolonged impairment of their tone, a condition of intestinal atony.

This condition may be caused by—

(*a*) The too rapid introduction of the irrigating fluid.
(*b*) The introduction of the fluid at too great a pressure.
(*c*) The retention of an excessive amount of irrigating fluid.
(*d*) The driving of gases further into the bowel.

3. The irritation and maceration of the mucous membrane of the bowel, with an increase of muco-membranous secretion which could be caused by the use of unsuitable substances or solutions at unsatisfactory temperatures.
4. The induction of hæmorrhage—
   (*a*) In the large bowel; or
   (*b*) In the stomach or small intestine.
5. The perforation of the bowel.

General Effects—

1. The development of undue fatigue, debility, etc. This can generally be avoided by encouraging patients in a poor state of health to lie down for a time after the treatment.
2. A fainting fit.
3. A syncopal attack.
4. An apoplectic seizure.
5. Poisoning owing to the use of unsuitable drugs.
6. An increased absorption of toxic material, owing to the solution of dried fæcal masses by the irrigating solution.
7. The development of a chill, especially after the Subaqueous intestinal bath.
8. Violent pains, nausea, a feeling of pressure in the epigastric region, vomiting, cold sweats, etc., are experienced by a certain percentage (3 per cent.) of patients who have an idiosyncrasy to the Plombières method of colonic irrigation.

De Langenhagen has pointed out that certain of these suggested dangers of colonic lavage cannot be confirmed.

The insinuation is frequently made that the Plombières method of colonic irrigation creates a habit, and that the patient begins to rely on the irrigations to empty the colon, and becomes dependent on them

in exactly the same way as those who habitually take purgatives for the same purpose. De Langenhagen emphasised that whether this is the case or not, the lavage at least does not cause irritation of the alimentary canal, whereas the habitual misuse of purgatives undoubtedly does have this effect. Hurst has also pointed out that the belief that the regular use of enemata is always harmful is quite erroneous.

The introduction of the new improved methods of continuous irrigation has completely overthrown this criticism, because these methods are generally able, in a short time, to re-educate the bowel so that it functions normally, the constipation is overcome, and no further treatment is required.

In the same way, the suggestion that these newer methods of colonic lavage foster and augment intestinal debility is now quite untenable.

It will be agreed that colonic lavage cannot create mucus when there is none present in the bowel. The explanation of the large amounts of mucus which are often recovered after colonic lavage is that the irrigating fluid simply removes and washes out mucus which has been lying in the bowel, and it is customary for the quantity of mucus to decrease steadily with each successive treatment. It is sometimes quite erroneously suggested that colonic irrigation produces colitis by removing the normal mucus from the bowel.

It is now generally acknowledged that colonic lavage does not cause dilatation of the bowel, but that the condition is due to the disease which has necessitated the lavage treatment.

When pain occurs, it is due to an excessive internal pressure.

Instead of the warm irrigating fluid causing maceration and softening of the intestinal membrane, there is no doubt that actually it has a stimulating effect on the colonic glands and muscles and a sedative action on the nervous system.

Friedenwald and Feldmann carried out some experiments on a number of male dogs for the purpose of investigating the effect of the prolonged use of colon enemas upon the bowel. In each case they injected one of the following substances daily per rectum : plain water, soap and water, cotton-seed oil, a solution of sodium carbonate, a neutral acriflavine solution, camphor water, a solution of ammonium chloride, and hydrochloric acid.

In the case of the plain water injections, the three dogs were killed at the end of 155 days ; the colonic membrane of one dog was unaffected, while the other two had congestion of the colon.

The soap and water enemas produced congestion and thickening of the colon in one case.

Three ounces of cotton-seed oil injected daily for 127 days did not produce any abnormality.

Solutions of from 5 to 20 per cent. of sodium carbonate produced ulceration of the bowel and death in two cases.

A 1 in 3,000 solution of neutral acriflavine injected for 115 days produced no abnormality in one case, and slight hyperæmia in the other.

Camphor water injections killed one dog in 29 days, while a 10 per cent. solution of ammonium chloride caused the dogs to die in 7, 8, and 13 days respectively from perforated ulcers, and the hydrochloric acid had an even more rapid effect, as the dogs died on the third day.

Their conclusions were that plain water, when used for colonic lavage over long periods, may cause mild inflammatory changes, that cotton-seed oil enemas do not produce irritation, and that a suitable acriflavine solution causes very little disturbance of the bowel.

It should be remembered that plain water is rarely used therapeutically for colonic irrigation, sodium chloride almost invariably being added to it to make an isotonic or slightly hypotonic solution.

Rayner has described three cases which he saw

personally, in which severe rectal injury was caused by the administration of an enema by means of a Higginson syringe. A trained nurse carried out the procedure in each case. The injury invariably follows the use of an unsuitable hard, conical nozzle, generally made of bone or glass. It is caused in one of the following ways :—

1. Poor exposure and illumination of the perinæum when introducing the catheter.
2. Placing the patient in an unsatisfactory position.
3. Insufficient lubrication of the catheter.
4. The use of force in introducing the catheter.

The membrane of the anal canal is damaged, and the irrigating solution is squirted into the submucous tissues with considerable force. Great pain, nausea, faintness, and collapse may occur.

The extensive sloughing which generally takes place is due to the injection, at great pressure, of considerable quantities of fluid under the mucous membrane. The accident is best avoided by the use of suitable rectal catheters.

Hawkes has recorded an interesting case in which a patient who was in the habit of giving himself colonic irrigations, accidentally produced perforation of his bowel. The patient used to fix a piece of soft rubber tubing to the water tap and introduce the free end into his rectum. One day, while doing this, he thought that the water was not flowing freely, so he turned on the tap more fully. Severe abdominal pain occurred, so he pulled out the tube, went to bed, and sent for his physician, who diagnosed the condition as rupture of the bowel. The patient was operated on six hours after the accident. A slit-like perforation, 2 in. long, surrounded by a dark hæmorrhagic area, was found in the pelvic colon. There was no thickening of the bowel or evidence of pre-existing disease. The perforation was closed, a cæcostomy was done, and the

patient recovered. Hawkes mentions in his article that he had known rupture of the bowel to follow the passage of a rectal bougie, and also from sudden distension of the bowel, due to the introduction of compressed air.

It is an interesting fact that in Vienna, up to the year 1922, 10,000 colonic lavage treatments had been given by the Subaqueous intestinal bath method, and only one death had occurred, due to perforation of the bowel in a patient suffering from an inflammatory condition of the bowel and peritoneum.

At Tübingen 12,430 treatments were given during the years 1922-27 without a single fatality.

CHAPTER IX

CONDITIONS IN WHICH COLONIC LAVAGE HAS PROVED BENEFICIAL

Colonic lavage can be used for either diagnostic or therapeutic purposes. The chief **diagnostic** uses are:—

1. The removal of the bowel contents for examination.

This procedure is especially useful in suspected cases of mucous and muco-membranous colitis, as lavage will almost always remove mucus from the bowel, and its appearance in the fæces enables a definite diagnosis to be made.

Other cases where similar information can be obtained are doubtful cases of chronic amœbic and bacillary dysentery, where examination of the stools will reveal the Entamœba or the bacillus, as the case may be.

In sprue, the copious, pale, fermenting stools with offensive odour, which are passed during colonic lavage, are very typical.

Colonic lavage often reveals whether parasites, or their cysts, are present in the bowel, especially *Oxyuris vermicularis*, the ellipsoidal cysts of *Lamblia intestinalis*, etc.

2. For the purpose of removing the bowel contents to enable an (*a*) external, (*b*) internal, or (*c*) Röntgen-ray examination of the abdomen to be made.

In certain cases, when the colon is filled with gas and fæces, it is almost impossible to make a satisfactory manual examination of the abdomen. The difficulty can often be overcome by a preparatory colonic irrigation.

Colonic lavage is a very useful preliminary to a procto-sigmoidoscopic examination. The procedure is also invaluable before Röntgen examination of the bowel, when either a bismuth meal or enema have been administered, or preparatory to examination of the kidneys, uterus, gall bladder, vertebral column, and pelvis.

In all these cases the removal of particles of hardened fæces and accumulations of gas ensures that a uniform field is obtained, and, consequently, errors in diagnosis are much less likely to occur.

Another use to which colonic lavage can be put is for the purpose of deciding in certain cases of constipation whether or not it is necessary to resort to surgical interference. It is often especially difficult to settle this point in cases of constipation due to adhesions. A short course of colonic lavage may relieve the constipation when dietetic or medicinal treatment has been quite unavailing, and when every other factor has pointed to the necessity of surgical intervention. On the other hand, failure of the irrigation treatment would be followed by a decision to operate.

Thorough cleansing of the colon can be effected by colonic irrigation, and there are a large number of cases in which this procedure can be carried out with great benefit to the patient before laparotomy or resection of the colon. The danger of the infection of the intestinal wound is greatly lessened. Irrigation is often helpful when carried out before an operation for radical cure of a hernia, as the bowel, which has been thoroughly emptied, occupies a smaller space.

Therapeutic Uses of Colonic Irrigation.—In considering the conditions which are benefited by colonic lavage,

it is obvious that they can be divided into certain groups, depending on the way in which the irrigation acts. In the case of intestinal disorders, colonic lavage often has a direct action and (*a*) removes the normal and abnormal contents of the bowel; (*b*) cleanses the mucous membrane and has a decongestive effect, and also, in certain cases, depending on the solution used, has an astringent, dehydrating, disinfectant, hæmostatic, purgative, or thermal action; (*c*) acts on the muscle coats of the bowel, induces peristaltic movements and a normal muscular tone, relieves spasm and indirectly causes vascular changes, stimulates the intestinal glands and the abdominal circulation. Reflexly, lavage influences various organs of the alimentary system, such as the stomach, liver, gall bladder, and pancreas in a similar way; it also increases the blood supply of the other pelvic organs.

There are a large number of conditions which benefit from the *eliminative* action of colonic irrigation. Disorders of the nervous and cardiovascular systems, metabolic disorders, dermatological conditions, and certain affections of the organs of special sense, in fact all the complaints which are due to auto-intoxication.

The diuretic action of the treatment is of great value in certain disorders of the urinary tract.

The **eliminative** action of colonic lavage is also useful in cases of acute and chronic poisoning, where it is a matter of great importance to empty the bowel as speedily and thoroughly as possible.

Cases of *acute food poisoning*, caused by eating unwholesome sausage, potted meat, meat pies, fish paste, etc., infected with certain micro-organisms, or their toxins, can often be relieved by a thorough irrigation of the bowel. It is well known that a number of people have an *idiosyncrasy* to certain foodstuffs, such as shellfish, strawberries, eggs, milk, etc., which cause gastro-intestinal irritation and the frequent appearance of skin eruptions, when they are present in the dietary.

Colonic lavage is an extremely useful method in such cases, when some unsuitable food has been taken unknowingly by a susceptible subject.

There are a number of complaints in which an allergic state exists, and where a thorough clearance of the bowel is beneficial; the principal disorders of this kind are asthma, migraine, vasomotor rhinitis, urticaria, etc.

Anaphylactic symptoms occur in a number of cases after the injection of some substance, such as antitetanic serum. Irrigation can be carried out with Formulæ Nos. 6 and 7, which contain hydrogen peroxide and charcoal respectively. Also in cases of chronic poisoning, due to such causes as the prolonged medicinal use of certain drugs; for example, salvarsan, various gold preparations (sanocrysin, aurophos), mercurial preparations. There is a danger of a mercurial colitis developing in syphilitic cases if particular attention is not paid to the bowels during the course of treatment. The drinking of large quantities of water, especially sulphur water, and frequent colonic irrigation with water containing some suitable preparation of sulphur, is an excellent prophylactic procedure in these cases. The non-poisonous black sulphide of mercury is formed and eliminated. Prescription No. 7 is also useful in old-standing cases of salvarsan poisoning, while Formula No. 8 is of value as an irrigating solution in cases with dermatitis, due to salvarsan, bismuth, mercury, or arsenic; and Solution No. 9 is used in iodine and bromine acne.

Chronic poisoning occurs in certain dangerous trades, especially in persons working with lead, and constipation and colic are important symptoms. A course of continuous colonic irrigation is invaluable in these cases. Professor Bier, of Berlin, first used colonic irrigation in lead poisoning to obtain stools for analysis at a given time, but now he employs the method as an important part of the treatment of this condition.

Another type of case in which irrigation is useful

is for patients suffering from drug addictions. In these cases, treatment of the bowel forms a very important part of the cure. People who have become morphia, cocaine, alcohol, or other drug addicts, are freed from the violent diarrhœa and the intense mental depression which are such prominent symptoms during the period of withdrawal. Huppenbauer has found that colonic irrigation greatly shortens the period during which the drug has to be given in reduced quantities, preparatory to its complete withdrawal. He recommends the administration of cardiac stimulants and the Subaqueous method of colonic irrigation to be employed every other day. He refers to the freedom from the craving which follows the treatment and the general improvement in health. Prescription No. 10 is useful for these cases.

Treatment of a similar character has proved useful in chronic tobacco poisoning; in many of these cases it is not possible to obtain complete abstinence, but periodical courses of treatment improve the general condition and cause the unpleasant taste in the mouth to disappear.

Helen Worthington has reported an interesting case of prolonged retention of certain indigestible matter in the bowel. The patient gave a history of dysentery followed by chronic enteritis. During the middle of the second Subaqueous bath irrigation, ½ pint of small seeds was passed. These were found to be raspberry, loganberry, and tomato seeds. The patient had not taken any berry fruits for over ten months because of the discomfort she had experienced after eating them.

Intestinal Parasites.—Apart from the use of colonic irrigation for the establishment of a correct diagnosis in suspected cases, it has great value in the treatment of certain parasitic infections of the bowel. Cases of *Oxyuris vermicularis* infection respond promptly to a short course of continuous irrigation. Solutions containing infusion of quassia, calumba, pomegranate bark,

santonin or oil of turpentine, can be used in these cases.

For patients who have some parasite lodged in the small intestine, colonic lavage forms a most valuable adjunct to the treatment by emptying the bowel and removing the anthelmintic and the dead tape or round worms.

Another group of cases in which the eliminative action of colonic irrigation is of great value is when there is auto-intoxication associated with constipation.

Constipation.—It is obvious that this symptom can be caused by a vast number of different conditions. It is extremely difficult to draw a sharp line between what constitutes a physiological variation and what is a pathological abnormality.

Normally, evacuation occurs once or twice a day. An abnormal condition is considered to be present when the food and its residue take more than forty-eight hours to traverse the gastro-intestinal tract, and it is more often due to functional causes than mechanical factors affecting the large bowel.

Constipation of short duration often occurs during an acute illness, after a journey, change of diet, change of drinking water, or during emotional distress; these conditions are, however, of a temporary character. The condition of long-standing constipation can also be due to a great variety of different causes, such as pressure on the bowel by a tumour, kinks due to enteroptosis, or adhesions, and stenosis of the intestinal canal due to ulceration and scarring. Constipation may be due to dyschezia. Inflammatory conditions in the abdomen generally cause constipation, as do certain disorders of the endocrine glands, certain psychical disorders, and some lesions of the spinal cord.

Functional derangements of the bowel associated with an abnormal muscle tone also cause constipation; so, too, do cases in which the diet is unsuitable and there is an insufficient food residue, excessive

amount of hydrochloric acid, or deficient amount of bile, etc.

The commonest symptoms of constipation are abdominal discomfort, which is chiefly a sense of fullness; dyspnœa and disordered action of the heart may result from pressure on the diaphragm. There is almost invariably loss of appetite, heartburn, coating of the tongue, and an unpleasant breath. Lassitude, headache, vertigo, and mental depression are other common symptoms.

Functional disorders of the colon may cause—

Atonic constipation,
Spastic constipation,
Pelvi-rectal achalasia,

and these may be associated with colic, tympanites, and intermittent diarrhœa; while dyschezia may be due to functional or organic causes.

Atonic or Hypotonic constipation is generally found in obese persons of a hypothyroid type, with flabby abdomens. Abdominal palpation is not painful, and it is rare for the patient to complain of any pain. The fæces are generally dry and hard. Röntgen examination reveals a distended colon.

The treatment of this condition necessitates a suitable dietary, adequate sleep, and outdoor exercise, and frequently a temporary abdominal support. The diet should contain a large amount of vegetables and fruits, eaten both raw and cooked, salads, wholemeal bread, honey, jam, lactose, etc., so as to ensure adequate food residues and a sufficient quantity of fermentable material.

Colonic irrigation with the Studa chair or Gymnacolon apparatus is invaluable in these cases; the colon is generally emptied of its fæcal accumulations at the first treatment. Enormous quantities of fæces are evacuated, and, consequently, the overstretching of the bowel is immediately relieved, and with successive treatments

the tone of the intestinal musculature rapidly improves, and the abdomen becomes visibly smaller, and a normal muscular tone is re-established.

In these cases the temperature of the irrigating fluid can often, with advantage, be lowered to 100° F., as this produces a greater stimulation of the bowel movements. In the case of the Subaqueous bath, cold douches can be applied to the abdomen. An ammonia enema is sometimes used in these cases. Prescription No. 13, which contains strychnine, can be employed for skin disorders associated with atonic constipation. The strychnine has a tonic action on the intestinal musculature.

Spastic or Hypertonic Constipation.—This vagotonic condition occurs in the neurotic, hyperthyroid person. Irregular constipation is the rule, and at intervals the fæces are semi-fluid, otherwise they are ribbon-like. Colitis is frequently present, and colicky pain is often experienced. When the abdomen is palpated, the colon feels like a thick cord, and is generally painful to the touch. A bland, non-irritating diet is necessary in these cases, one which leaves very little residue. No fruit or vegetables must be taken, or foods likely to increase fermentation.

A belladonna suppository can be inserted about half an hour before the commencement of the irrigation, and, in severe cases, belladonna and kamillosan may be added to the irrigating fluid. In other cases the lower part of the bowel is emptied and 200 to 300 c.c. of fluid containing 3 mg. of atropine are slowly introduced. When relaxation of the bowel has taken place, which is usually the case after a few minutes have elapsed, the irrigation is continued. Some physicians inject 1 to 8 oz. of medicinal paraffin into the rectum before the irrigation is commenced. The irrigating fluid, in these cases, should always be used at a temperature of 106° to 108° F. and an electric heating pad applied to the abdomen; or, in the case of the Sub-

aqueous bath, warm abdominal douches should be given. Formulæ Nos. 14 and 15 can be used in constipation of this type. Prescription No. 16 is useful in cases where there is tenesmus or sphincter cramp.

Pelvi-rectal Achalasia, Megalocolon, or Hirschsprung's Disease.—This is a very uncommon condition in which there is generally a history of constipation from birth. Distension of the abdomen soon occurs. Drugs are of little avail, and evacuation can only be obtained with colonic irrigation. Sufferers from this condition often die at a very early age. Olpp has described an interesting case of megalocolon, which he curedwith colonic irrigation.

The patient was a Brazilian boy, nine and a half years of age, who had suffered from stubborn, chronic constipation. Röntgen photographs showed great enlargement of the ascending and transverse colon. Enormous quantities of fæcal matter were passed at the first irrigation. After fifteen treatments with the Subaqueous bath, the bowels acted regularly. After six treatments, Röntgen photographs showed an almost normal appearance of the bowel, and others taken three weeks after the termination of the course of treatment, showed even more striking changes. The child was seen at intervals for one and a half years, and the cure was maintained.

Dyschezia is the term applied to the condition in which the patient is unable to defæcate completely, the rectum usually containing large amounts of residual fæcal matter. Dyschezia may be due to a variety of different causes, such as diminished responsiveness of the rectal reflexes, weakness of the voluntary muscles concerned in the act of defæcation, habitual disregard of the call, reflex inhibitions, and, in certain cases, it may be associated with hysteria.

Colonic irrigation is the only satisfactory method of treating these cases and of ensuring their complete recovery, as it is essential for the rectum and pelvic colon to be kept empty, so that their normal tone can be

re-established. The irrigating fluid should be used at a temperature of 100° F. Treatment may have to be given for a considerable time before the bowel regains its normal contractile power. Dietetic treatment and the use of purgatives is of no value whatsoever in these cases.

Colic is often caused by flatulent distension of the bowels, or by incomplete fæcal obstruction. Colonic irrigation is a reliable method of relieving these two conditions.

Flatulence is chiefly caused by bacterial fermentation occurring in the bowel; some of the gas is, however, swallowed with the food. Normally, gas is eliminated from the bowel by absorption, the remainder being expelled as flatus. When the mucous membrane is inflamed, normal gaseous absorption does not take place, and flatulence is generally present. A similar condition occurs in cirrhosis of the liver.

Diarrhœa may be a symptom of many different disorders, and is frequently caused by the ingestion of unsuitable food, or excessive secretion of bile; colonic irrigation removes the cause of the intestinal irritation and, therefore, generally relieves the condition. Irrigation should be administered once or twice a day in the summer diarrhœa of infants.

Malposition of the Colon—Coloptosis.—Laxity of the muscles of the abdominal wall is one of the commonest causes of enteroptosis, especially when it is associated with a diminution in the amount of intra-abdominal fat. The loading of the bowel, due to constipation, which is nearly always present in these cases, aggravates the condition. The chief cause of the constipation is probably the weakness of the abdominal muscles, but kinks may be present, especially at the splenic flexure, and there is nearly always congestion owing to the tension on the vessels. Colonic irrigation by means of the Gymnacolon apparatus or the Studa chair is invaluable in this condition, and the troublesome

symptoms can, in the majority of cases, be caused to disappear, the constipation can be cured, and the abdominal pain banished. Dyspnœa, which is present in some cases, is also relieved. The irrigating fluid not only empties the bowel but also tends to straighten out any kinks which may be present.

As it is customary for fifty or sixty evacuations of the irrigating fluid to take place at each treatment, the abdominal muscles are vigorously exercised and their tone improved.

Röntgen photographs taken before and after treatment do not reveal as great a difference as the complete disappearance of the symptoms would lead one to suspect.

The increase in the intra-abdominal pressure which follows colonic irrigation, and which is due to the improved tone of the abdominal muscles, produces an amelioration of the symptoms associated with ptosis of certain organs, such as the kidneys.

Adhesions and Kinks.—Colonic irrigation can be successfully employed in the treatment of adhesions and kinks. The beneficial effect is probably due chiefly to the improvement which takes place in the circulation, but the gentle dilatation which the irrigating fluid causes in the constricted areas, also plays a part. In certain of these cases an intermittent valve-like obstruction occurs, but the irrigation is generally able to eliminate this obstacle. Colonic irrigation, as has already been stated, forms a valuable method of deciding whether surgical interference will be necessary in cases where there are adhesions or kinks ; if no improvement follows a course of lavage, an operation will probably be required.

Constipation during Pregnancy.—Colonic irrigation has proved of great value in these cases. Formula No. 17 is generally employed.

Gaenssle, of the Women's Clinic at Tübingen University, says they have never seen a pregnant woman harmed in any way by the treatment.

Auto-intoxication.—This condition generally occurs when the fæces remain in a fluid state and when there is ileal stasis. The majority of bacteria are present in the cæcum. Auto-intoxication occurs most often when the intestinal mucous membrane is inflamed or injured, and when there is marked intestinal stasis. The normal liver filters out, and neutralises, the poisons which are present in the portal vessels, but if the liver is diseased, intoxication is prone to occur, as the poisons are able to pass unhindered into the general circulation. The thyroid gland performs a similar function as the liver, in this respect, but on a much smaller scale. The remaining poisons are eliminated from the body by the kidneys, skin, and lungs, and this probably accounts for the characteristic odour of the sweat and the unpleasant breath, which are such frequent symptoms of these cases.

It is a matter of great difficulty to determine which conditions are definitely caused by auto-intoxication, but there is no doubt that there are a large number of disorders which do arise in this way. An outline of the conditions which are thought to be caused in this manner, and which are, therefore, benefited by colonic irrigation, will be given, as they form a very important group of cases. Kaolin is of value in the treatment of these cases, also Formula No. 21.

Metabolic or Nutritive Disorders.—There seems no doubt that certain cases of malnutrition are caused by constipation and auto-intoxication, and clinically, it is found that many cases improve after a course of colonic irrigation with the Gymnacolon or Studa chair apparatus. Anorexia soon disappears.

Certain cases of *anæmia* are probably due to hæmolysis, caused by toxins which enter the blood stream through branches of the portal vein; these cases improve when a normal condition is established in the colon. Cases of purpura hæmorrhagica improve when irrigated with Solution No. 28.

There is some intimate association between intestinal stasis and *gout*, because chronic constipation is almost always present. The fact that the tendency to gout is inherited, rather suggests that the mucous membrane of the bowel in these cases has a low resistance against the absorption of toxins. Improvement in elimination is always beneficial, and an acute attack of gout can often be cut short by colonic irrigation. Prescription No. 18, which contains sodium salicylate and ammonium chloride, is useful for this purpose.

In *acidosis*, especially in post-operative cases, colonic irrigation with alkaline solutions and dextrose is often of great value. Solution No. 19 is useful in this type of case.

Hyperemesis Gravidarum.—Gaenssle, of the Women's Clinic, Tübingen University, has found colonic irrigation a very valuable adjunct in the treatment of these cases.

Endocrine Disorders.—It is probable, as has already been stated, that the thyroid gland plays a part in the destruction of intestinal toxins which have been absorbed into the circulation, and that hyperplasia of the gland may occur when there is excessive toxin absorption. The pigmentation which is frequently present in patients suffering from chronic constipation may be due to the effect of intestinal toxins on the suprarenal glands.

Colonic irrigation soon causes this condition to disappear.

Disorders of the Nervous System.—Persistent headaches are frequently due to auto-intoxication, and a short course of colonic irrigation is efficacious in these cases.

Migraine is often caused by constipation, especially when there is distension of the rectum and pelvic colon. Clearance of the bowel by colonic irrigation will give immediate relief to a number of sufferers. In more severe cases the headache may only disappear some hours after the treatment, which confirms the fact that auto-intoxication is present. Constipation frequently occurs in *chorea*, and probably causes aggravation of the symptoms. Many authorities believe that

constipation associated with toxæmia may act as the exciting cause of the fits in *epilepsy*. The incidence of fits is certainly lessened when the bowels are kept in a normal condition. Colonic irrigation is a valuable adjuvant in the treatment of this malady.

Vertigo, which in a number of cases is caused by intestinal toxæmia associated with constipation, is frequently relieved by lavage of the colon.

Neuritis.—Many cases of neuritis are caused by auto-intoxication. Neuritis of the left sciatic nerve may also be caused partly by direct pressure of the distended iliac colon on the sacral nerves. Colonic lavage frequently relieves the pain.

Cases of **Insomnia,** associated with constipation, are almost invariably benefited by colonic lavage.

Neurasthenia.—Constipation, which is frequently present in neurasthenia, often leads to an aggravation of the other symptoms of the disorder. Colonic irrigation plays an important part in the treatment, but other forms of therapy are also necessary. Neurasthenic patients who suffer from pruritus are often relieved of this symptom when they have colonic irrigation with Solution No. 30.

Mental Disorders.—Kaiser has published interesting results of the use of colonic irrigation in certain mental disorders. He considers that fæcal stasis is probably the cause of many obscure psychoses, and also that it is responsible for such symptoms as apathy, irritability, perverted moral feeling, melancholia, mania, and even, in certain cases, suicidal inclinations.

He made Röntgen examinations after the administration of barium meals to three groups of patients, viz. :—

1. Sufferers from dementia præcox.
2. Manic depressive cases.
3. Psychoneurotics.

He assumed that the normal time for the elimination of a barium meal was 36 to 48 hours, and that periods

longer than 48 hours revealed some degree of intestinal stasis.

In 80 per cent. of the cases examined, more than 48 hours was required for the passage of the barium through the alimentary canal. He found that in *dementia præcox*—

86 per cent. of the patients required more than 48 hours.
56 „ „ „ „ 100 „
27 „ „ „ „ 150 „
16 „ „ „ „ 200 „

The average time being 113 hours and the maximum 360 hours.

With the *manic depressives*—

76 per cent. of the patients required more than 48 hours.
51 „ „ „ „ 100 „
47 „ „ „ „ 150 „
33 „ „ „ „ 200 „

The average time was 154 hours and the maximum time 408 hours.

With the *psychoneurotics*—

67 per cent. of the patients required more than 48 hours.
33 „ „ „ „ 100 „
1 „ „ „ „ 150 „

The average time was 80 hours and the maximum 166 hours.

Colonic irrigation was given for several months. Seventeen per cent. of the dementia præcox group recovered, 50 per cent. improved, 40 per cent. being released on trial.

Seventy per cent. of the manic depressive group recovered, 15 per cent. improved, while 85 per cent. were released on trial.

In the psychoneurotic group, 80 per cent. recovered and were released on trial.

Circulatory Disorders.—Intestinal toxæmia probably causes cardiac irregularity in certain cases, though the

flatulence which is present may be partly responsible. Arteriosclerosis may also be produced by intestinal toxins, which have a direct action on the vessel walls.

Certain cases with bad circulation in the hands and feet are strikingly relieved by colonic irrigation.

Olpp has described a case, a man of fifty-one years of age, who had had an irregular pulse for a considerable number of years. Shortly after the commencement of his first treatment with the Subaqueous intestinal bath, the pulse became regular and remained so during the course of the irrigation and for an hour afterwards. Olpp thinks that this effect was due to some action of the irrigation on the vagus and sympathetic nerves.

The beneficial effect of colonic irrigation in lowering blood pressure in cases of hyperpiesia has been frequently acknowledged. Naturally, the cases of high blood pressure unassociated with arteriosclerotic changes or chronic nephritis have responded most satisfactorily.

There seems no doubt that some pressor substance is frequently formed in the colon when intestinal stasis is present, which is responsible for the rise in blood pressure. An excessive amount of cholesterol was found in the blood of 71 per cent. of a series of cases which were recently investigated.

Bisset treated a number of cases of hyperpiesia with intestinal douches. Blood-pressure readings were taken before and after the lavage. He recorded decreases of from 10 to 40 mm. of mercury, and though the pressure rose to nearly the original figure twelve hours later, there was a steady decrease over a period of days.

He found an average fall in the blood pressure of the male patients of 37·6 mm. of mercury, and of 32·5 mm. in the case of the women.

He considers that the improvement in these cases is due to the elimination of pressor substances from the bowel.

Abnormally low blood pressure is also frequently associated with constipation, and colonic irrigation is

valuable in the treatment of the disorder. Formula 22 is useful in cases of cardiac arrhythmia.

Respiratory Disorders.—Asthma is frequently associated with constipation. Hurst considers that there is probably a recto-respiratory reflex, and that distension of the rectum with fæces produces dyspnœa. Regular colonic lavage frequently secures immunity from asthmatical attacks in a certain number of cases.

Chronic Bronchitis.—Persons suffering from this complaint are frequently benefited by colonic lavage.

Rheumatic Disorders.—The gastro-intestinal tract is frequently the focus of infection in rheumatic disorders of muscles, fibrous tissues, and joints, and for this reason colonic irrigation is often of great value. Constipation, mucous colitis, and arthritis occur so frequently together, that it is almost impossible for the association to be an accidental one. The auto-intoxication which often follows constipation leads to a general lowering of tissue resistance and an increased liability to other infections.

Fletcher and Grahame investigated, by means of barium enemas, the condition of the colon in a number of patients suffering from various rheumatic disorders. They found that the large bowel showed some abnormality in 65 per cent. of the cases they examined, cæcal lesions being especially common.

Striking results have been published by a number of physicians of the dramatic improvement in arthritis which frequently follows the re-establishment of normal bowel activity, and the cessation of intestinal toxæmia.

There is no doubt that many cases of muscular rheumatism or fibrositis have an intestinal origin, and that this fact accounts for the improvement which intestinal lavage produces. Prescription No. 23 is of value in these cases, and radium emanation (Prescription No. 29) in cases of arthritis associated with psoriasis.

Diseases of the Skin.—Colonic irrigation is of great value in a number of skin disorders, and this treatment

should always be given when chronic eczema, acne vulgaris, rosacea and psoriasis are associated with constipation. Prescriptions Nos. 24 and 25 are beneficial in acne, and No. 29 in psoriasis associated with arthritis. Excellent results have been obtained in a large number of cases, especially in acute recurrent erysipelatous eczema.

In constipation the skin frequently has a most unhealthy, sallow appearance, and it often has an offensive odour. Pigmentation commonly appears, especially round the eyes, and abnormalities of the sweat glands, such as anhidrosis, bromidrosis, and hyperhidrosis, also occur. These symptoms quickly disappear when regular evacuation of the bowels is obtained. Urticaria, lichen urticatus, and pruritus form another group of skin conditions which is associated with intestinal toxæmia. Urbach has published particulars of 37 cases of urticaria and 12 of lichen urticatus, which he treated by colonic lavage, using Solution No. 30 with uniform success, surprising improvement being noted after even one or two intestinal baths. He was also successful in 12 cases of pruritus senilis, in which he used Solution No. 31, containing sodium silicate. Cases of angio-neurotic œdema also do well.

The skin diseases which are associated with rheumatism, viz., erythema nodosum, erythema multiforme, and purpura rheumatica, are generally benefited by a course of colonic lavage. Solution No. 27 is generally used for the irrigation in these cases. Reference has already been made to the value of colonic irrigation in the treatment of cases of purpura hæmorrhagica on p. 159.

Some authors have found improvement follow colonic douching in certain cases of alopecia prematura, herpes, seborrhœa, and furunculosis; Solutions Nos. 25 and 26 being recommended for use in the last-named condition.

Diseases of the Eye.—It is difficult to say whether constipation plays much part in the causation of certain eye conditions; but many persons suffering from constipation experience such symptoms as muscæ

volitantes, eye-strain, hyperæmia of the conjunctivæ, etc. Colonic irrigation frequently affords relief in these cases.

Maillard, of the University Eye Clinic, Tübingen, considers that the application of colonic lavage frequently shortens the duration of such conditions as scrofulous diseases of the lids, conjunctiva and cornea, iritis, irido-cyclitis, and retrobulbar neuritis.

Disorders of the Throat, Nose, and Ear.—Cases of sinusitis associated with constipation generally benefit from colonic irrigation. One patient told me that, before the lavage, he was, on an average, using seven to eight handkerchiefs a day, but that after the course of treatment one sufficed. The cause of this amelioration was undoubtedly the improvement which took place in his general health. Colonic irrigation is frequently a valuable adjunct in vasomotor rhinitis.

The Genital Organs.—There is no doubt that congestion of the female genitalia is caused by constipation, fæcal masses pressing on the veins draining the sexual organs. Various aches and pains, such as a feeling of weight in the lower part of the abdomen, backache, etc., arise in this way. Colonic irrigation with the Gymnacolon apparatus or the Studa chair not only empties the bowel of fæcal accumulations and relieves the pressure on the veins, but the rhythmically produced evacuations also stimulate the circulation of the pelvic viscera.

Constipation always intensifies *dysmenorrhœa*, and, therefore, colonic lavage often has a very beneficial effect, Solution No. 32 being used in these cases.

Leucorrhœa and *menorrhagia* are also frequently helped.

Varicocele and *testicular neuralgia* are commonly caused by constipation, especially when the rectum is distended.

Seminal emissions and *penile erections* frequently follow the same condition. Intestinal lavage is a valuable procedure in all these cases.

Colonic irrigation has great curative value in another large group of cases where there is inflammation of some part of the intestinal canal. The eliminative action of the lavage is advantageous in these conditions, but the bathing of the intestinal mucosa with certain solutions which may be demulcent, antiseptic, or astringent is also of great importance. The disinfectants most commonly used are albargin, calomel, cyllin, dimol, mercurochrome, mercury perchloride, potassium permanganate, proflavine, quinoxyl, silver nitrate, stovarsol, and yatren.

The infectious diseases of the bowel which respond most satisfactorily to colonic irrigation are bacillary and amœbic dysentery and sprue.

Dysentery.—Colonic irrigation is of great value in the treatment of bacillary and amœbic dysentery. Most of our experience has been with chronic amœbic cases, patients who have been invalided home from the tropics, and who are still passing frequent, unformed stools. These cases clear up in a surprising way after a short course of lavage.

Various medicaments, such as emetine, yatren, or dimol, can be added to the irrigating solution, and they undoubtedly shorten the period of treatment. Occasionally, owing to atony of the musculature, dysentery may be followed by constipation ; lavage nearly always cures these cases. Solution No. 33 is used in mild cases of colitis following dysentery. Five litres of the irrigating fluid should be used daily, while the diarrhœa persists. The lavage is only given every third day when the stools commence to be formed.

Carbonate of lime and iron, which act favourably on the inflamed mucous membrane, are formed in the bowel by the irrigating solution.

For the treatment of severe cases of post-dysenteric colitis, Formula No. 34 is employed. This solution has a sedative action, and should be used every other day until the pain has subsided or the evacuations have

become formed. Solution No. 33 should then be used once or twice a week. The special diet should be continued for four weeks, and the return to normal food should be very gradual.

Sprue.—We have had an opportunity of treating a number of very long-standing cases of sprue; rapid amelioration followed the commencement of colonic irrigation. A short course of treatment invariably sufficed to establish a normal condition of the bowels.

Colitis.—Colonic irrigation is used extensively for the treatment of various forms of colitis, acute and chronic catarrhal colitis, muco-membranous colitis, and mild, early cases of ulcerative colitis. By this method it is possible to apply direct treatment to the affected colon, and so avoid the procedure, which is of very doubtful value, of giving intestinal disinfectants by the mouth.

The irrigation, when given by the Gymnacolon or Studa chair methods, thoroughly cleanses the colonic mucous membrane, relieves the congestion, acts on the intestinal glands so that their secretions become normal, and stimulates the muscular tissue of the bowel. The treatment, in fact, acts as an internal bath, relieving spasm and pain. De Langenhagen found that 70 per cent. of the 17,000 cases of chronic colitis which passed through his hands benefited from the Plombières method of colonic lavage. There is no doubt that the percentage would have been higher if the Gymnacolon or Studa chair methods had been used.

The inflammatory condition may be limited to one region of the bowel; if the cæcum is affected, it is known as typhlitis, and the terms iliac colitis, pelvic colitis, and proctitis are used when the iliac colon, pelvic colon, and rectum are respectively the principal seats of the trouble. Irrigating Solution No. 35 or linseed decoction are used in cases of chronic proctitis.

Acute Catarrhal Colitis, which is generally characterised by diarrhœa, colic, abdominal tenderness, and stools

containing mucus, usually has an abrupt onset. Colonic irrigation soon terminates the condition.

Chronic Catarrhal Colitis may arise in a variety of ways, the abuse of aperients, alimentary toxæmia, and fæcal stasis being, perhaps, the most frequent causes. The commonest symptoms in these cases is constipation of a spastic type, though there may be intermittent attacks of diarrhœa, accompanied by abdominal pain. Anorexia is generally present, and gaseous eructations are common. The stools frequently contain mucus, and occasionally blood. These cases respond satisfactorily to a course of colonic irrigation which empties the bowel, removing irritating substances, and bathes and soothes the inflamed mucous membrane. Pelvic colitis is generally the most refractory, and may require prolonged treatment.

Muco-membranous Colitis.—This condition, which occurs commonly in neurotic individuals, is characterised by constipation and the passage, at intervals, of membranes, sometimes accompanied by attacks of colicky pain. The membranes interfere with the normal functioning of the bowel, and cause congestion and spasmodic contractions. The membranes, which vary greatly in size and appearance and are frequently tubular in structure, are formed of coagulated mucus. Colonic irrigation is the most satisfactory form of treatment. Relief is obtained when hard fæcal accumulations are removed from the bowel, and when the membranes are detached from the mucous membrane. Lavage given with the Studa chair or the Gymnacolon apparatus can frequently permanently cure the constipation, which is such a prominent symptom of this condition. Solutions of sodium carbonate or boric acid are frequently used for irrigation in these cases.

Certain critics of the Plombières method of colonic lavage have suggested that it causes an increased amount of membranes to be formed; this is certainly not the

case. What actually happens is that the irrigating fluid removes membranes which have been lying in the bowel for a considerable period, as their shrivelled appearance proves. A large quantity of membranes may be passed during the first few irrigations, but afterwards the amount tends to decrease steadily.

A suitable, bland dietary should always be taken by patients suffering from this disorder; the improvement in the general health is generally most striking.

Ulcerative Colitis.—Mild and early cases of ulcerative colitis can be treated by colonic irrigation, but great care must be taken, and no cases should be irrigated where there is any risk of perforation. A solution containing bismuth subcarbonate can be used.

Diverticulitis.—Chronic constipation appears to play an important part in the causation of diverticula, though atrophy of the muscle coats of the bowel and an abnormal amount of fat in the bowel wall are other factors.

The diverticula, which nearly always occur in the lower part of the descending, iliac, and pelvic colons, generally contain hard fæcal concretions. Inflammation of the walls of the diverticula usually occurs. Colonic lavage, which remedies the constipation and removes fæcal accumulations, is of value in the treatment of early cases of *diverticulosis* when there is no danger of perforation occurring.

Peritonitis (Tubercular).—Colonic irrigation with hot solutions will often relieve the pain which may occur in this condition.

Appendicitis.—Constipation is undoubtedly a cause of chronic appendicitis, especially when the cæcum and ascending colon are the seat of stasis, and when there is catarrhal inflammation. Colonic irrigation can be employed with benefit in all cases which are free from the danger of perforation.

Anal Fissure is generally caused by constipation. Colonic lavage, which relieves this symptom, is therefore

of value in the treatment. Antiseptic solutions can be used in the irrigating fluid.

Hæmorrhoids.—The pressure of accumulated fæces on the hæmorrhoidal veins is one of the principal factors causing hæmorrhoids. Colonic lavage which can relieve constipation is, therefore, of great value in the treatment of internal uncomplicated hæmorrhoids. Continuous irrigation also improves the tone of the colonic vessels. Coldish astringent solutions containing adrenalin can be used, as they cause the veins to contract.

Pruritus Ani is often due to the presence of hard fæcal masses in the rectum, and colonic lavage, therefore, gives relief in a number of cases. Helen Worthington has described an old-standing case of pruritus associated with hæmorrhoids in which the irritation entirely disappeared after five treatments.

There are a number of conditions in which the action of colonic irrigation is chiefly a *reflex* one.

Gastric and Duodenal Disorders.—This method of treatment often relieves the symptoms of *anorexia*, because the secretion of the gastric juice is reflexly stimulated by the active colonic movements which the lavage induces. Patients frequently comment on the increased appetite which the treatment produces.

The removal of putrefactive matter from the bowels also plays a part. Constipation generally disturbs gastric digestion, causing heartburn, flatulence, loss of appetite, furring of the tongue, offensive breath, etc. Hurst suggests that these symptoms may be due to intestinal intoxication or to reflex or hormone action, which produces an intimate physiological connection between the various parts of the alimentary canal, disturbance of the functions of one part upsetting the functions of another.

Reverse peristalsis may occur, leading to imperfect emptying of the stomach, or bile may regurgitate into the stomach.

Dyspepsia and Gastric Stasis are often relieved by colonic irrigation which reflexly stimulates stomach movements. Solution No. 38 is used in fermentative dyspepsia. Irrigation with hot solutions in *gastralgia* often affords relief. Constipation is almost always present in cases of *gastric ulcer*, and it is generally associated with *hyperchloridia*. Colonic irrigation which relieves the intestinal stasis is therefore a useful accessory method of treatment in such cases, and also in certain disorders of *intestinal secretion*. Solution No. 36 is used for cases of gastric ulcer with slight pain, Solution No. 37 when there is considerable pain, and Solution No. 20 in cases of hyperacidity.

Diseases of the Liver, Biliary Tract, and Pancreas.—Colonic irrigation is of value in a number of disorders of the liver and biliary tract. The effect is partly reflex and partly due to the improvement which occurs in the whole abdominal circulation, following the use of the Gymnacolon apparatus or the Studa chair. Huppenbauer has drawn attention to the fact that the liver, even in cases of chronic enlargement, has never shown signs of being adversely affected, though it is the first organ to be influenced by the large quantities of water which are usually absorbed by the colon during irrigation.

Biliousness and congestion of the liver are benefited by colonic lavage. When cirrhosis of the liver is present, the organ is not able to deal adequately with toxins absorbed from the bowel, and naturally these are increased when there is intestinal stasis. Lavage counteracts the constipation which is such a frequent symptom in cirrhosis.

Catarrhal Angiocholitis.—Irrigation is a useful adjunct in these cases. Hot irrigating solutions will sometimes relieve the pain in biliary colic.

Jaundice (Catarrhal).—The disappearance of jaundice is hastened considerably by frequent colonic irrigation, and as constipation is nearly always present in these

cases, the treatment also relieves this symptom. Treatment is given each day and two to six applications are generally required. Kuttner has described a case of toxæmic jaundice which cleared up after ten days' Gymnacolon treatment, and in which the enlarged liver rapidly decreased in size.

Cholecystitis is frequently caused by chronic constipation. Irrigation benefits this condition by relieving the intestinal stasis, and probably there is also a reflex effect. Solution No. 39 is used in these cases.

Cholelithiasis.—Constipation is also present in the great majority of these cases.

Disorders benefited by the Diuretic Action of Colonic Irrigation.—*Nephritis*—Colonic irrigation, which eliminates the contents of the large bowel, lessens the absorption of toxins, and this is of great importance in nephritis when the excretory power of the kidneys is greatly reduced.

Colonic irrigation with hot solutions is sometimes of value in *renal colic* for the purpose of relieving the pain, and small *renal calculi* are sometimes passed after a course of treatment. Solution No. 40 is used in these cases.

Oxaluria.—The profuse diuresis which follows colonic irrigation has been found to be extremely valuable in curing cases of persistent oxaluria.

Pyelitis.—Constipation may cause pyelitis, owing to the absorption of bacteria from the bowel and their subsequent passage through the kidneys. Colonic lavage not only relieves the constipation, but leads to prolonged flushing of the kidneys. The profuse diuresis follows the absorption of large quantities of the irrigating fluid by the intestinal mucous membrane. Cases of *B. coli* infection respond most satisfactorily, and can be completely cured often in a surprisingly short time. Solution No. 42 is useful in the treatment of mild cases.

Ureteric Calculi.—Colonic irrigation is specially

indicated in the treatment of this condition. Calculi which are small enough to pass along the ureter are frequently expelled after a few treatments. Irrigation is carried out with hot solutions in these cases, and this relieves the pain to a certain extent, and atropine is added for its antispasmodic effect. The expulsion of the stones is principally due to the marked diuresis which is produced, and which causes increased ureteric peristalsis. Kortzeborn, of the Surgical Clinic, Leipzig University, published in 1928 an account of seventeen cases which he had treated in this way. A series of Röntgen photographs was taken in every case, and these showed that each irrigation caused the stone to move a little lower down the ureter, until it eventually passed into the bladder.

He found that in two cases the stone was ejected after the first treatment, in five after the second, in seven after the third, and once after the fourth, fifth, and ninth irrigations respectively.

In several of the cases quoted, other methods of treatment had been unavailing. This form of treatment is unattended by any risks, and can be used for out-patients as well as patients in hospital.

Cystitis.—This condition, whether caused by the *B. coli* or by other organisms such as the streptococcus, staphylococcus, etc., is greatly benefited by a course of colonic irrigation, and often in a comparatively short time.

The circulation is improved, especially of the pelvic veins, and diuresis occurs soon after the irrigation, and may frequently continue for as long as twenty-four hours. Muller advises one or two Subaqueous bath treatments to be given at intervals of two or three days, and then irrigations of shorter duration to be administered every day. He also suggests that the irrigating solutions should be varied at frequent intervals, saline, alkaline and ichthyol solutions being used in succession.

Prostatic Disorders.—Colonic irrigation can be used before prostatectomy when micturition is not too difficult, flushing of the bladder takes place, and the lavage has a decongestive action on the prostate and other pelvic organs. Solution No. 43 is used in these cases. Irrigation has also been used in the post-operative treatment of prostatectomy.

When it is considered how useful colonic irrigation is in such a large number of different conditions, it is surprising that it is not employed more frequently than is the case at the present time. There seems no doubt, however, that colonic lavage, which is a branch of physical medicine, is destined, like other similar methods of treatment, to play an increasingly important part in medical practice.

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